ELECTRICAL REVIEW

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Prizes at the Paris Exposition.

A cable message from Paris gives the following names of American exhibitors who received prizes:

American Bell Telephone Company—Grand prize.
Cobb Vulcanite Wire Company—Gold medal.
Thomas A. Edison—Grand prize.
Elisha Gray, Illinois, telegraphy—Grand prize.
Heisler Electric Light Company, St. Louis—Gold medal.
Okonite Company, New York—Gold medal.
Elihu Thomson, Lynn, Mass., electrical pliances—Grand prize.
Western Electric Company, Chicago—Gold medal.
Sprague Tramway Company—Gold medal.
Volta Graphophone Company—Gold medal.
Massachusetts Institute of Technology, Boston—Gold medal.
New York University—Grand prize.
Rensselaer Polytechnic Institute, Troy—Grand prize.
Smithsonian Institution, Washington—Grand prize.
Johns Hopkins University, Baltimore—Grand prize.
H. A. Rowland—Gold medal.
Herman Hollerith, Washington—Gold medal
United States Signal Service, A. W. Greely, chief officer—Grand prize.
United States Naval Observation—Grand prize.

American Electricians in London.

[Cable Despatch to *N. Y. Sun.*]

Edison has come and gone. He arrived in London last Sunday morning and left on Friday to take the steamer for New York from Havre Sept. 28. Edison might have been entertained to any extent if he had so desired, but he was not well, and refused all invitations except to quiet luncheon with the Lord Mayor. Most of his time was spent in inspecting the Edison electric light stations. He did not have a consultation with the British Cabinet about the proposal to include Canada in the Patent Convention, and neither, thus far, has Senator Evarts inquired at the Colonial office. However, the fact is revealed that R. D. McGibben, of Montreal, the lawyer who represents the Westinghouse and Thomson-Houston Companies here, has lodged a protest against any action being taken in the matter. Leonard E. Curtis and Edmund Wetmore of New York are also here in the interests of the Westinghouse Company, to resist any effort on the part of Mr. Evarts to bring the Edison incandesent filament patent under the terms of the International Patent Convention. H. M. Byllesby, general manager of the Westinghouse Company in Pittsburgh, is in London with a staff of electrical engineers to superintend the construction and equipment of the works of the English company, which has just been organized with £600,000 capital.

New Mechanical Devices.

The Missouri Electric Light Company has put in some new machinery at its plant. The improved apparatus received for feeding fires is a most striking illustration of the tendency to do everything by machinery. It does away entirely with the necessity of handling coal after it is dumped from a wagon, and in a few weeks will have all the ashes made by the furnaces carried off mechanically. When a car load of coal is ordered it is dumped into a chute, and as quickly as it is shovelled in is carried off by machinery similar to that used to haul it up from mines. To persons who have never seen a coal mine being worked, it will give them a clearer idea of the principle on which the machinery operates to say that it is the same as that on which water is drawn from a well. The coal, when drawn into the ascending boxes of sheet iron is carried up towards the roof of the building and is automatically dumped into other chutes, which drop it into large iron receptacles similar in size and shape to water tanks. From the bottom of these two iron pipes, with a slight curve, extend to a point just over the furnace door. All that is necessary is to turn a crank and all the coal necessary can be dumped into the furnace. By a most ingenious arrangement the fire feeds itself and discharges its clinkers and ashes. The ashes have to be hauled at present, but in a few weeks machinery similar to that which takes up the coal will be run right underneath the furnace grates and the ashes will be carried out as they fall and dumped in the lot. The company will put in two 250 horse-power engines in a few days in place of the two small engines now operated. This will give them four 250 horse power engines. In the near future four more engines of a similar capacity will be put in on the opposite side of the building to that which those at present in use are located. The plant will then be able to supply 50,000 lights.

The Westinghouse Electrical Works.

A despatch from Pittsburgh says that the recent fire in the shops of the Westinghouse Electric Company was reported by Acting Vice-President Charles Pease, as "really a fortunate thing. Our lamp factory was formerly in those rooms up stairs, but we have removed them to New York City, and that part of the building was vacant. The operation of our works is not in the least interrupted by the fire. The men are all at work. I have telegraphed to Newark, N. J., where we have factories as well as here, and they will immediately go ahead with a double force to reconstruct the machines destroyed." Another prominent official of the electric company, speaking of the fire was reported as saying: "This will hasten the plans which Mr. Westinghouse has been considering for some time, namely, the removal of the works to Wilmerding. Ever since Mr. Westinghouse purchased that place he has been considering the advisability of removing all his works there. The air-brake works are almost finished. The Fuel Gas Company's works will shortly be built. Plans have already been prepared for a glass-house to make incandescent light globes, and the works of the electric light company will no doubt go next." Wilmerding is a new town created by Mr. Westinghouse. It is 14 miles east of Pittsburgh on the line of the Pennsylvania Railroad.

A NEW ELECTRICAL TRICYCLE—INVENTED BY M. M. M. SLATTERY, FORT WAYNE, IND.

After long and persistent efforts, Victoria, Texas, will at last get electric light and power. The Victoria Light, Power and Ice Company has been formed and machinery ordered. The Westinghouse system has been adopted and the charter has been forwarded. The directors are T. M. O'Connor, G. H. Levi, J. M. Brownson, J. K. Hester, D. H. Rogan, Simon Levi and J. A. McFadden. This company absorbs the Crystal ice factory and will probably connect a steam laundry with the factory. It is expected to have lights turned on within six or eight weeks.

Portland, Ore.—The Willamette Heights Railway Company; to operate for 30 years a street railway; the cars are to be operated by electricity, has been organized.

The Slattery Electrical Tricycle.

The engraving illustrates a perspective view of a large tricycle which is propelled by an electric motor, which, in turn, is operated by a storage battery which is disposed in the centre of the carriage, the work of that inventive genius, M. M. M. Slattery, of Fort Wayne, Ind. The storage battery consists of 13 cells, 6x6x8, each cell weighing about 11 pounds, making a total weight of 143 pounds. The motor has a capacity of about half horse-power, and has delivered to it from the battery 10 amperes of current at 26 volts electro-motive force. The cell has a capacity of a hundred ampere hours. In starting the tricycle the current is switched into the motor, which runs up to speed. By a clutch arrangement upon the axle of the carriage the latter is gradually started with a motor running at its highest rate of speed. The advantage of this disposition of the apparatus is that the storage battery does not discharge through the motor when the latter is started at the same time that the full load is on; and it has been found desirable to bring the motor up to its highest rate of speed and subsequently gradually throw the load on it. The arrangement for carrying out this latter mechanical movement is exceedingly simple, the lever for the purpose being placed close to the operator who is guiding the carriage, but when it is necessary to stop the carriage all that is to be done is to throw the clutch out and turn a switch which cuts the current off. The carriage then immediately stops. It has been found that upon ordinary well-kept streets that such an apparatus can be used with fair economy; that is to say, the cost should not exceed five to eight cents an hour during use unless the grades are very steep and the streets are in very poor condition. Upon asphalt pavement this carriage could be used with great economy, and its exceeding simplicity, combined with the expeditious manner in which one can, so to speak, hitch up one's horse, gives it a very attractive feature.

During the visit of a REVIEW representative at Fort Wayne recently, the electrical "horse" was in use in a large hall, where a church fair was being held, and its work viewed by wondering hundreds. Our artist was enabled to get a view of the machine as the inventor himself was gaily showing its qualifications.

Electric Railway at Peoria.

The generators for the electric cars at Peoria, Ill., are now being put in, and the road will be ready to run in a few days. At each end of the car is an enclosed place in which the driver will operate the brake, closed in so that he cannot be distracted while at his work. The cars are combined for summer and winter use. In winter the heavy plate glass windows shut out the cold; in summer the windows will be slipped down, and the cars will be airy and open. They are furnished with Pullman car curtains and spring seats, elegantly upholstered in crimson plush. This plush is removable in summer, and there is a cool cane seat bottom.

The Washington, Penn., Electric Street Railway Company, of Washington, Pa., has been chartered. It will be three and one-half miles long and will use the Sprague motor. L. N. Singley is president. Pittsburgh capitalists are interested.

Ft. Wayne's New Electrical Works.

THE EXTENSIVE AND MODERN FACTORIES OF THE FT. WAYNE ELECTRIC COMPANY.

The city of Ft. Wayne, Ind., is inhabited by nearly 50,000 persons, and not one of them in recounting the institutions of the city fail to point out the new and greatly enlarged factory of the Ft. Wayne Electric Company, the progressive company so long known to the readers of the REVIEW as the Ft. Wayne Jenney Electric Light Company. This attractive Western city has three great manufacturing industries—the electric light, the Bass steam engine and car wheel works, and the P., F. W. & C. and Wabash car shops. The electric light company, although the newest of the three, was one of the earliest in the field of electric lighting, and its history has been that of continual advancement. Undaunted by the destructive fire of November, 1888, the company immediately commenced the work of planning out a new, greatly enlarged modern and convenient factory. The REVIEW is pleased to present its readers with a number of views of the new factory, which it, along with every one interested in the progress of electrical work, takes pride in noting.

Those of our readers acquainted with electric lighting need not be told that the energetic head of this vast establishment is Mr. R. T. McDonald. To him is to be awarded greatest praise and credit for the continued success of the Ft. Wayne Company. Yet he has ever had faithful co-workers in Messrs. Bass, Olds, and others of Ft. Wayne, who saw the great future that electric lighting had before it.

Mr. McDonald is credited with being one of the most energetic electric light managers on a large scale that is in the business, and the REVIEW thinks it not amiss to give him this word of praise for the work he has done in developing the industry. The Fort Wayne Company is equipped with a thoroughly capable staff, with M. M. M. Slattery, the well known inventor of the Slattery induction system, at the head of the electrical work. A fine laboratory, devoted entirely to experimental work, adjoins the factory and office buildings, but is not shown in our engraving. Here Mr. Slattery, the happiest of inventors, will find full play for his talents, and will have a number of expert assistants, with a complete assortment of fine instruments so fondly desired by all electrical workers of an inventive turn of mind.

The illustration of the factory shows in front the office building, detached from the large factory. The first floor is occupied by the executive officers and clerical force, a telegraph operator having an office in one corner, the extensive business demanding this convenience, as well as the railroad facilities that the admirably selected location secures. The second floor of this building will be occupied by the legal department, with Judge Taylor at the head and Mr. J. E. Talbot as his able chief assistant. The other buildings, of which we present interior views which were taken while the representative of the REVIEW was present, and at a time when the company was hardly entirely moved into its new quarters, are fitted up throughout with thermo-automatic sprinklers of the most approved pattern. These fire safe-guards were put to the test of a fire kindled by means of oil and shavings, and worked to a charm, drowning the fire out the instant the temperature reached the proper degree. The Fort Wayne Company does not intend that a second fire shall destroy its works, and, although the late fire resulted in a much more complete edifice being erected, does not desire that method of development to again enter into consideration. Ample grounds around the factory have been secured for building additional factories, should such be necessary at any time.

Fig. 2 (page 6) is the machine room, size 300 by 55 feet, in which all the planing and heavy machine work is done, and where the dynamos are set up in a complete form.

Fig. 3 comprises a view of the converter room where all the coils of the converter, both primary and secondary, are wound, and complete apparatus is assembled and set up. This room is 140 by 55 feet.

Fig. 4 presents a view of the winding room, where the armatures and fields of the dynamos are wound and a few of the brass work details of the machines are made. This room is quite large, as will be seen, and is 300 feet long by 55 wide.

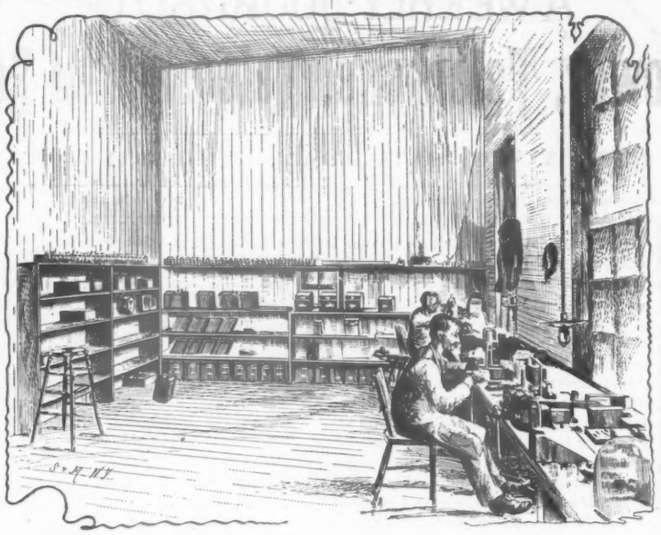

FIG. 6.—INSTRUMENT ASSEMBLING ROOM, FORT WAYNE ELECTRIC COMPANY.

Fig. 5 is a view of the meter and instrument room, in which all the details of both are manufactured. It is 140 by 55 feet.

Fig. 6 shows a smaller room, where the meters and instruments are assembled and completed.

THE COMPANY'S REPRESENTATIVES.

In additional to the staff mentioned above, the Fort Wayne Company has recently secured the services of Mr. Brainard Rorj-son, formerly of Indianapolis, who will act as assistant manager, the Indianapolis Jenney Company having been absorbed by the Fort Wayne Company. Outside of Fort Wayne the company has branch offices in every leading city of the Union, in Canada and Mexico. Col. H. C. Adams is the well-known Eastern representative, and W. J. Buckley, of Chicago, and G. A. Wilbur, of Philadelphia, are the wide-awake managers in the cities named. Mr. W. J. Morrison, of Canada, takes active care of the company's interest in that country, as well as assisting in a general way in other parts of North America. The Manhatian Electric Light Company is the sole licensee for New York City and Brooklyn.

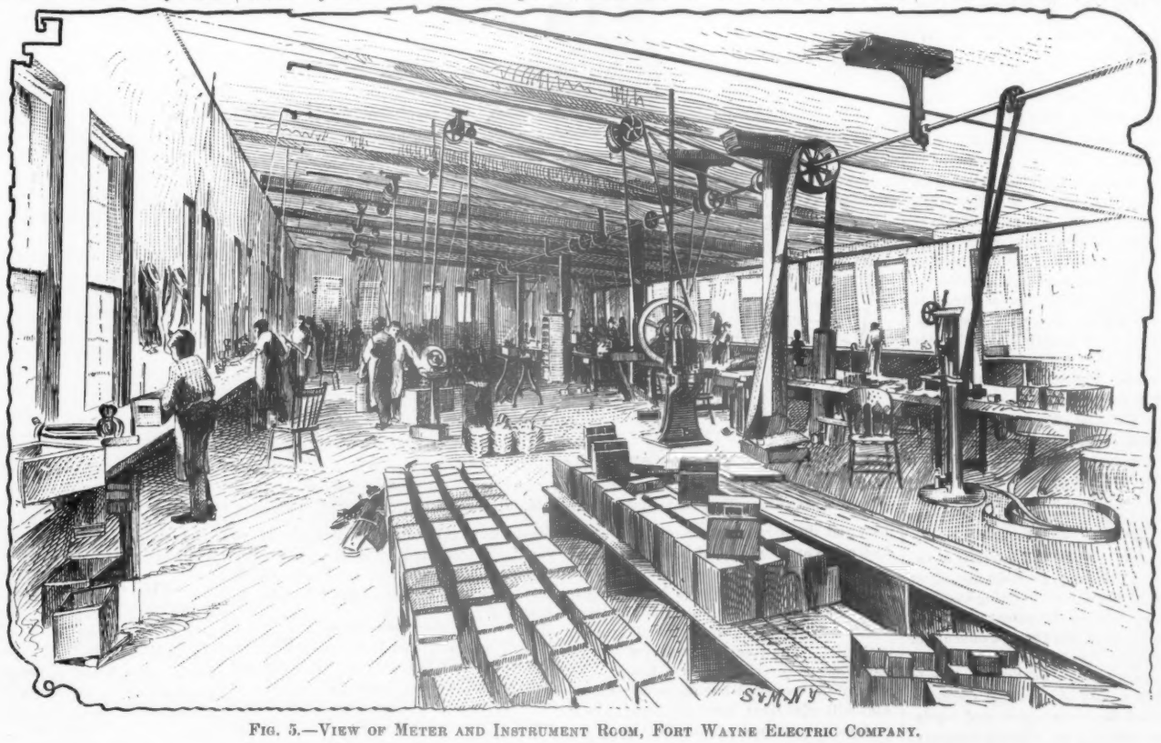

FIG. 5.—VIEW OF METER AND INSTRUMENT ROOM, FORT WAYNE ELECTRIC COMPANY.

Some Figures Relative to Mixtures of Water and Sulphuric Acid.

BY LEONARD PAGET, PH.D.

M. Gaston Roux, with the view of serving those having to do with accumulators or batteries, has constructed a table enabling the operator to effect any desired mixture of sulphuric acid and water. He has determined by actual trial the specific gravities of mixtures of water and acid, also the electromotive forces of small Planté elements filled with these solutions, similarly mounted and charged in series. The other figures have been deduced by calculation.

MIXTURES OF WATER AND SULPHURIC ACID AT 17°C.

Volumes of water mixed with 1 vol. of acid.	Degree Baumé.	Density.	Weight in grams of acid per litre.	Per cent. by weight of normal acid.	Specific Resistance in ohms-cm.	E. M. F. of Planté accumulator in volts.
4	26.2	1.222	390	31.9	0.825	2.105
4.5	24.0	1.200	355	29.8	0 853	2.085
5	22.3	1.183	370	27.1	0.882	2.065
5.5	20.7	1.167	296	25.4	0.911	2.050
6	19.7	1.157	270	23.4	0.940	2.033
6.5	18.7	1.149	253	22.0	0.970	2.022
7	17.8	1.141	236	20.7	1.010	2.010
7.5	17.0	1.134	223	19.7	1.040	2 000
8	16.2	1.128	210	18.8	1.072	1.992
8.5	15.3	1.120	200	18.0	1.095	1.992
9	14.7	1.113	190	17.2	1.125	1.992

It will be observed by inspection of this table, that the degrees Baumè may be obtained by adding four to the number formed by the first two decimal figures of the densities: thus, the density being 1.16 the degree Baumè will be 16+4=20, and this is closely true for mixtures of 1 volume of acid and 4 to 9 volumes of water.

Further, for mean mixtures (6 volumes of water to 1 of acid) generally employed in accumulators, by again adding 4 to the degrees Baumè there is obtained the amount per cent. in weight of normal acid. Again adding 4 and multiplying the sum by 10 gives the weight in grams of normal acid per litre.

To obtain the volume of water x mixed with 1 volume of acid, the number 1,900, divided by the weight in grams of acid per litre, with 1 subtracted, will give the result required. Thus a liquid containing 320 grams of acid per litre is composed of $\frac{1,900}{320}$ —1=5 volumes of water to 1 of acid. These rules may be worked out mentally. They are purely empirical, and refer to a temperature of 17° C.

A New Clutch Application.

The Sherman Electric Storage Equipment Company, of Boston, are exhibiting a new electric power transmitting machine or clutch, the invention of Mr. William F. Sherman, who claims the invention of and patent on the overhead or trolley system of electric street railways. The idea in this clutch is to do away with the extra energy required in overcoming the inertia of cars, boats, and all forms of machinery electrically propelled, in starting.

The mode of applying the clutch to street cars is to arrange the motor that the armature shaft shall run lengthwise of the car under the floor, occupying a space six feet in length by 18 inches wide, and shall rest on a yoke which has insulated boxes on the axles and gearing at both ends of the axle, so that there is no interference with the easy motion of the car springs. The increasing momentum of the armature, which runs free until the clutch is applied, accumulates energy for starting the car, and when the clutch crank is turned extra power is obtained without an increase of electric energy. This extra power is said to be equal to the efforts of two horses in ordinary horse railway practice.

The economy of the system is claimed to be very considerable, and to materially aid in the economical use of the storage battery system, beside being an improvement for the overhead or conduit systems. According to the company's figures, a 10 horse-power motor will show a 30 horse-power contact for starting the car, with a 10-horse steadily pushing power. The apparatus is applicable to any car now in use with but slight modifications, and the company are preparing to manufacture the armatures and clutches on a large scale at their own shops.

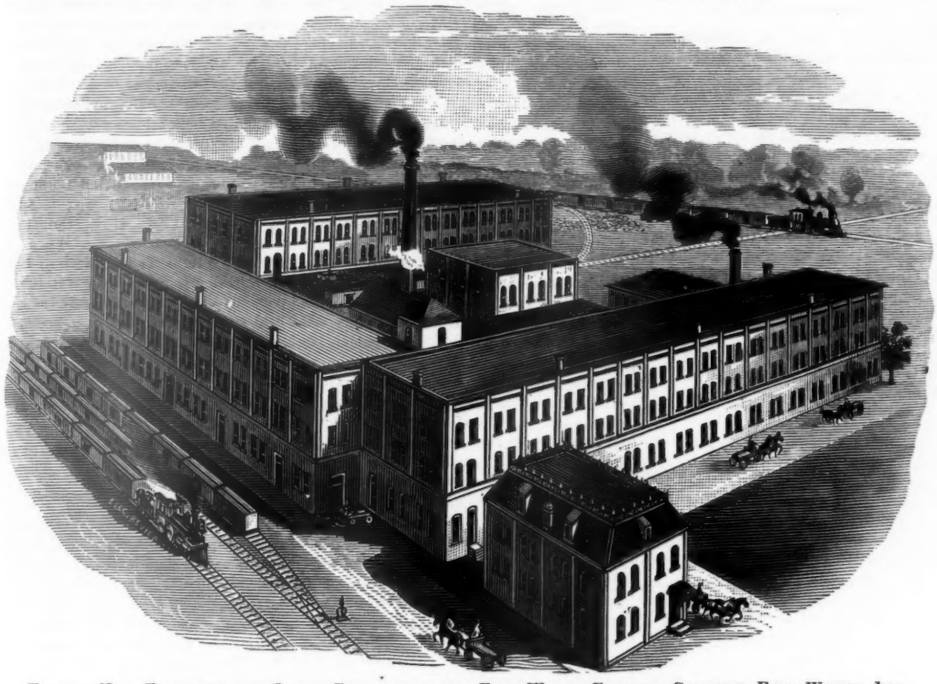

FIG. 1.—NEW FACTORIES AND OFFICE BUILDING OF THE FORT WAYNE ELECTRIC COMPANY, FORT WAYNE, IND.

Grafton, Md.—The Grafton Gas and Electric Light Company has been chartered; capital stock, $50,000.

Harrisburgh, Pa. — The Waynesburg Electric Light and Power Company, Waynesburg, Greene county; capital, $15,000.

Portland, Me.—The Electric Piano Company is a recently incorporated company at Portland, Me., to carry on the business of the application of electricity to pianos. The capital stock is $500,000; paid in $75,000; par value shares, $25. President, Frank W. Bailey, N. Cituate, Mass.; treasurer, Robert D. Wilson, Boston, Mass.

Portsmouth, O.—The Portsmouth Gas and Electric Company, Portsmouth; capital stock, $100,000.

Bridgewater, Mass.—The Bridgewater Electric Company, Ferdinand A. Wyman, president, and Arthur S. Palfrey, treasurer; capital, $15,000.

Pittsburgh, Pa.—A charter was filed recently in the Recorder's office for the Maple Creek Telephone and Telegraph Company, Pittsburgh, Pa. The company intends to construct a line from Pittsburgh to points in Washington county. The capital stock is $3,000, divided into 30 shares, at $100 per share. The directors are James B. Oliver, George T. Oliver, David B. Oliver, John Phillips and Horace Crosby.

Skowhegan, Me.— The Union Electric Light and Power Company has been formed at Skowhegan by J. W. Gould, F. O. Newman and others, with a capital stock of $15,000.

St. Louis, Mo.—The Electric Construction Company, capital, $3,000, filed articles of association with the Recorder. The stockholders are John Stocker, Charles Stagl and B. A. Suppan.

Chicago, Ill.—The Chicago Suburban Street Railway Company is incorporated with a capital of $125,000. The incorporators named were S. Clendennin, E. E. Harbert and Anthony Schiller.

Chicago, Ill.—International Electric Company, of Chicago; to manufacture electric apparatus; capital stock, $3,000,000; incorporators, Samuel W. Adams, Charles S. Raddin, Nathan Whitman.

East St. Louis, Ill.—The Citizens' Electric Light and Power Company, of East St. Louis, to furnish light and power; capital stock, $25,000. Incorporators, Henry D. Sexton, Stephen D. Sexton and Anthony Isch.

Randolph, Mass.—A franchise has been granted by the board of selectmen to the Randolph and Holbrook Electric Light and Power Company, with the right to establish a plant, erect poles and string wires within the limits of the town.

New York City.—The Crosby Electric Company has been incorporated with $100,000 capital. Its object is the manufacture of electrical apparatus, and the trustees are Stanley Y. Southard, Clarence M. Griswold and Charles M. Van Heusen.

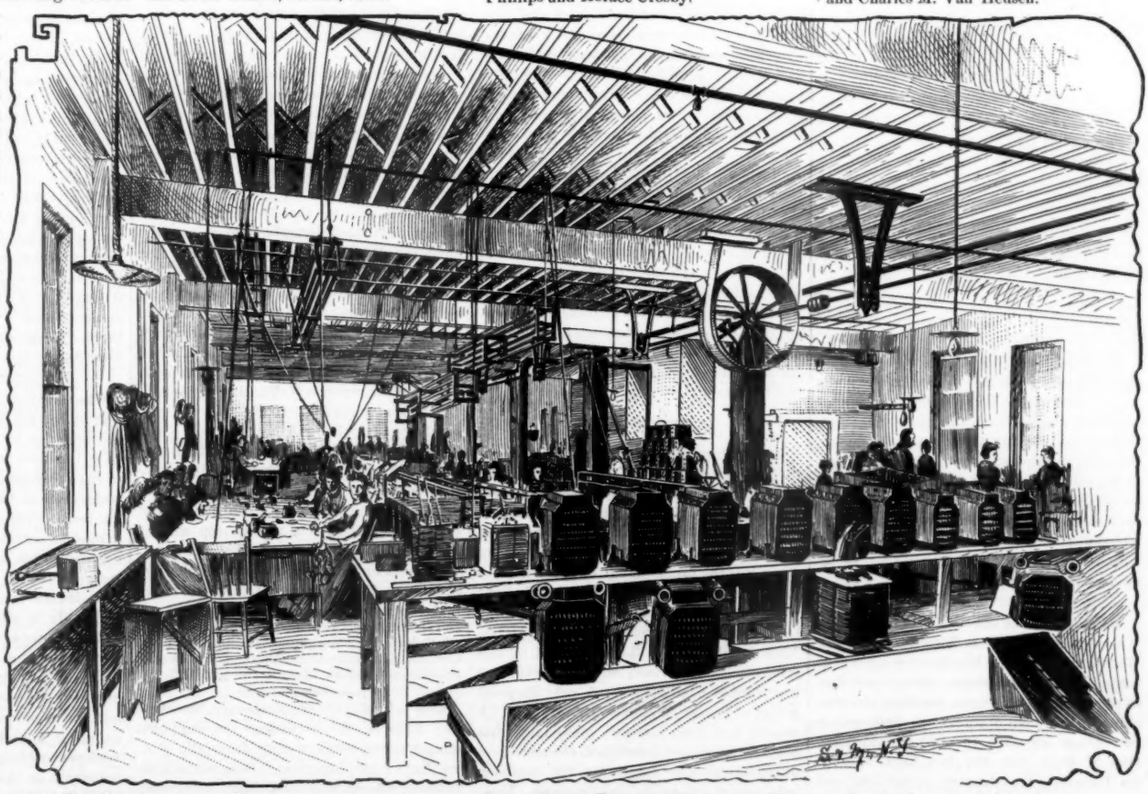

FIG. 3.—CONVERTER ROOM OF THE FACTORY OF THE FORT WAYNE ELECTRIC COMPANY.—(See pages 6 and 7 for other illustrations.)

Baltimore, Md.—The National Electric Motor and Manufacturing Company has been incorporated. Capital stock, $250,000.

Monticello, Minn.—The Monticello Electric Light Company filed articles of incorporation with the Secretary of State last week. The capital stock is $5,000, and the incorporators are Henry Kries, Theodore F. Tilly, Charles Strout, E. H. Sherwin, A. F. Barker and A. K. Keays, all of Monticello.

Montreal, Can.— Letters of incorporation have been applied for on behalf of "the Merchants and Jewelers Electric Protection Company," with a capital of $100,000, of which Detective Grose will be manager. The provisional directors are Messrs. J. A. Grose, S. W. Foster, J. S. Archibald, Q. C.; A. B. Chaffee, Sen.; Edmund Guerin, G. G. Foster and S. B. Foster.

Winchendon, Mass.—The Winchendon Electric Company, of Winchendon; capital, $15,000; Ferdinand A. Wyman, president; Arthur S. Palfray, treasurer.

Alexandria, Va.—The American Electrical Supply and Appliance Company, capital stock, $500,000, has been chartered to manufacture electrical machinery and appliances.

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☞ No attention will be paid to communications without the *name and address of the writer.*

We invite correspondence from Electricians, Inventors, and the Telegraph and Telephone fraternity and those engaged in Electric Lighting, on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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The Wheeling, W. Va., *Graphic*, a new and well-edited journal, in its heading gives evidences of appreciating electricity, an incandescent lamp illustrating the giving forth of light and electric wires that of securing prompt intelligence from all parts of the globe. The *Graphic* is edited and published by Tucker, Faris & Tucker, Mr. Will S. Faris of the firm being an experienced and talanted young journalist, and is meeting with a success that is most gratifying to its progressive publishers.

A funny mistake occurred at the opening of the Industrial Fair at Toronto. Sir John Macdonald had made his opening speech of congratulation, and before calling upon him to press an electric button starting the machinery, President Withrow invited one or two other speakers to deliver addresses. One of them was Mr. Jno. Leys, M.P.P. for Toronto. He advanced to the front and laid his heavy white hat right on top of the electric button. Instantly there was a shrieking of whistles, and the machinery in the building began to go like mad. The crowd roared with laughter, and after much gesticulation and running about the managers stopped the proceedings and the machinery was restarted by Sir John and Lady Macdonald.

Preparations are nearly completed for construction of a telegraph line from Pen-Ting-Foo, near Pekin, through Shansia, to connect with Russian telegraph system at Kiakhta. With such a combination of languages we fear the telegraph operator's life will not be a happy one.

Mr. Eugene T. Lynch, Jr., chairman of the committee on standardizing of electrical apparatus for street railways, which was appointed at the last meeting of the National Electric Light Association, is now sending out a circular letter to all the street railway companies asking a number of material questions. The circular announces that it has been thought advisable to compile the opinion and experience of all the street railways that have adopted electricity as motive power. The electric railway companies thus addressed should not fail to make a very complete report, for the work of this committee will undoubtedly be of great importance. This committee is composed of Mr. Lynch, chairman; Marsden J. Perry, of Providence, and T. Carpenter Smith, of Philadelphia.

In view of the unparalleled growth of the electrical industries of the country since the census of 1880 was taken, Mr. Robert P. Porter, the superintendent of the census for 1890, has determined to make a special investigation with reference to this subject. It has been decided to intrust the inquiry to the care of Mr. A. R. Foote, of Cincinnati, Ohio, who has been recommended by the National Electric Light Association, and also by nearly every individual firm interested in this industry, as well as prominent men throughout the country. While Mr. Foote's appointment has not yet been officially announced, there is no question that he will be selected for this purpose. He will make a most acceptable and thoroughly capable official, and we think the electrical interests will be pleased throughout to hear of Superintendent Porter's action.

The rapid rise in stocks of large electrical corporations has not failed to create a favorable impression among investors, both large and small, a condition of things which has been and will be taken advantage of by unscrupulous adventurers to foister stocks of a more or less doubtful value upon a too confiding public. The result in some cases is a realization when it is too late, that the term electrical has been used as a magnet to draw the unwary investor into a stock-jobbing scheme, wherein the only profits come to the originators of the enterprise in the form of cash from the sales of stock. With its firmly established hold, these affairs cannot work much injury to the legitimate business, yet their influence is sometimes far-reaching, and that they should be nipped in the bud is for the interest of the electrical fraternity and the prospective dupes alike.

It seems remarkable that the testimony of such interested parties as officers of existing gas companies, as to feasibility and economy, should have weight against the establishment of competing electric light plants, as seems to be the case. The strange thing about it is the rapid change of opinion as to the value and economy of the electric light which these individuals undergo when the business is to be carried on by themselves. Their intellects seem illumined as if by this same electric glow, and new ideas supplant their former fixed beliefs. A case in point is that of a large Western city which, with several hundred thousand inhabitants, has never enjoyed the benefits of electric street illumination—due largely to the opposing influence of a powerful gas company. Now, however, after successfully thwarting attempts by outside parties to establish plants for street lighting, the gas company itself is about engaging in electric lighting on a large scale and the city streets will now be brilliant. This is one case, and as is said in the topical song, "There are lots more."

ELECTRICITY AS A RAILWAY SAFEGUARD.

That such an accident as the overtaking and running down of one fast train by another should occur on so great a railway as the New York Central and Hudson River Railroad is a disgrace to its management. Here is a great trunk line with four tracks, powerful and fast engines, experienced engineers and trainmen, carrying thousands of human souls daily, train following train, and all rolling along the brink of eternity. For what is there in the equipment to prevent a repetition of the calamity which last week befel the first section of the St. Louis and Chicago Express? Simply nothing. This permitting two sections to fly along unguarded by any signals other than they can make to each other is almost a crime, when the lives of our citizens are taken in the collisions which under the circumstances are inevitable.

The New York Central prides itself on its four tracks, its fast trains, its luxury and its alleged security against accidents to its patrons; but it doggedly refuses to use the only means of real security which exists against collision between passenger trains—the block system and the electric telegraph which is its distinguishing feature and on which it is founded. True, it costs something to put it in force on a long railway, but then it does not permit lives to be sacrificed ruthlessly in the mad rush to keep up the reputation of high speed The block system is a positive preventive of such collisions, and if great railways do not adopt it they should be compelled to do it by the legislature. All the principal railways in England are operated on the block system. The magnificent Pennsylvania Railroad in this country is equipped from end to end with the most approved apparatus for block-signaling in keeping with its general policy to have only the best of everything which conduces to the safety of its patrons. Its example of prudence in this respect has been followed by the Erie, the Boston and Albany, the Chicago, Burlington and Quincy and other trunk lines, and travellers on these lines feel perfectly secure against collision. But the New York Central, to its shame be it said, prefers to add a few thousands to its earnings annually and let its passengers follow the adage and "take pot luck." Luck has been with them generally, but it may desert at any moment and precipitate a disaster a hundred-fold worse than that which happened near Palatine Bridge. The engineer of the second train says it was the fault of the air brake, the rear brakeman of the first train says he couldn't get back quickly enough, a superintendent blames the engineer of the first train for not stopping sooner; but these are all wide of the mark. It was none of these things; it was the fault of a system which permitted the second train to approach the first, a system almost diabolical when viewed as a measure of economy. After all, is there economy in it? The damage to rolling stock may reach $50,000, while the personal damages will far exceed that sum; and this total loss would probably equip the entire road from New York to Buffalo with every requisite of the block system, towers, semaphores, instruments and all. But adoption of such a reliable system would stop wildcat trains, would sometimes delay traffic a bit, would add to the wages and construction accounts; and the only advantage would be actual security for the lives of the passengers. But the passengers are a part of the public, and what does the management of the New York Central R.R. care about that? We all know the famous remark about "the public."

Our valued daily contemporary, the *Mail and Express*, in discussing the supposed danger to the public welfare from the electric light wires, suggests: "How would it do to make officers of electric light companies walk underneath their own wires?" We would inform the editor of our V. D. C. that where he stands one chance of getting killed by an electric light wire he stands 76 chances of falling down and breaking his neck. Perhaps it would be just as well to leave the wires alone for a short time while he agitates the question of better pavements in our streets.

ELECTRICITY IN THE DAILY PRESS.

The remarkable increase in the popular use of electricity, so to speak, has naturally occasioned a demand for information on the subject from the readers of the daily press who are outside the reach of the electrical papers, a demand that is not satisfied apparently by the electrical news departments which are now regular features of many newspapers, but calls for the production of special electrical editions embodying electrical knowledge, galore from the pens of eminent writers, but couched in simple language that calls for no previous elementary study for its proper understanding. One of the leading Boston papers issued last week an edition of this sort, containing among others, papers from the pens of Ferdinand A. Wyman, Prof. A. E. Dolbear, Prof. Silas W. Holman, George W. Mansfield, Alex. P. Wright, Thomas Kirwan and Francis E. Galloupe. The issue is illustrated by portraits of men prominent in the electrical field either as inventors or in business management, and by cuts of electrical apparatus and its varied applications.

EVOLUTION OF THE INCANDESCENT LAMP.

Mr. Franklin Leonard Pope, the author of a new and valuable contribution to electrical literature, entitled "Evolution of the Electric Incandescent Lamp," says in his preface: "The critical student of affairs perceives, that however wonderful or however unexpected an invention may appear, it is seldom that it is not found to be a necessary sequence of a long series of other discoveries and inventions which have preceded it." The history of electric illumination is no exception, and in his work the author has brought together detached fragments of that history and arranged them in an accessible form, so that the student not only can draw from them the facts, but from their sequence and correlation can deduce information of value in other lines of original work.

Beginning with some facts in the early history of electric lighting, Mr. Pope has carefully gathered together the court history, the contemporaneous newspaper comments and the patent claims of the several workers in the field, and woven this material with statements and comments from his own pen into a story which, to one interested in the subject, is as absorbing as a novel. A feature which adds to the value of the work for reference, especially, is a carefully prepared chronological table of the discoveries and experiments which led to the modern incandescent lamp. Another advantage which the book possesses is that of being up to the times in matters of recent occurrence, the very latest facts and court decisions being embodied in its pages. ["Evolution of the Electric Incandescent Lamp," by Franklin Leonard Pope, 1889. Henry Cook, publisher, Elizabeth, New Jersey.]

The people of Harlem are again reminded that all the iniquity of this wicked world is not confined to the electric wires, for they have just been treated to a total extinction of the gas, resulting from the bursting of a water main and the consequent rupture of a gas main. The climax was capped by a gas explosion sufficiently powerful to shake up one part of the town and throw things about regardless of the feelings of the people in a New Haven train directly over the broken main. It is amusing to notice with what stoicism people endure the inconveniences attendant upon the use of gas and water. Evils that are long standing are apt to be regarded as necessary. Let a gas burner leak or a water pipe burst, and the long suffering householder endures the inconvenience without a murmur, but let the telephone or the electric light fail, and the average citizen is at a loss for words to express his disapprobation. Well, there is a grim satisfaction in knowing that the next generation will bear these troubles without a murmur, and will vituperate against modern conveniences not yet invented.

The electrical exhibitors at the Paris Exposition all seem to have been well rewarded.

ELECTRICAL NEWS.

Boston, Kansas City, Chicago and Washington.

OUR CHICAGO LETTER.

Personal.—Old friends of General Manager Henry Ward Leonard were gratified to meet him once more in Chicago this week. The object of Mr. Leonard's visit was made apparent a little later. Prof. Badt, of the Western Electric Company, accepted a position with the Edison, and will again be shoulder to shoulder with his former comrade in arms, Manager C. C. Warren, as constructing engineer.

Mr. Chas. D. Shain, formerly with the United States Company, but latterly with the Westinghouse Company in Cincinnati, goes to New York for the Edison Company.

F. W. Horne, who has so long and earnestly labored for the interests of the Excelsior lighting and motor systems, rumor has it, will drop the former, and pay especial attention to electric railways. The Excelsior Company is just commencing to operate the Rockford, Ill., as well as several other electric railways, and F. W. will hereafter have general supervision of that department of the Excelsior Company's business in the West.

Decatur, Ill., has gone into spasms again over another electric railway just started. There are four Pullman cars running on the two miles of track just opened, which makes a total of eight miles of electric road now in operation. There are also two dynamos for incandescent lamps, with a total capacity of 1,600 lights. The railway system used is the Rea.

The Chicago Exposition has lost but little by the fire. One of the booths, which has not been rebuilt, has a large cloth placard on which is painted in black letters a statement that this was the place where the beautiful, etc., etc., was. The building is lighted by 144 Sperry lamps, and a new exhibit is going in as I write, consisting of a 30 light Excelsior, with lamps of both the arc and incandescent varieties. All the lights have been ordered out of the locked booths, save in a single instance where there is nothing to burn.

The South Side Electric Co., with headquarters at the Fort Wayne Jenney office, has opened out for business with a Slattery alternate machine, and is now running about 550 lamps of that system. This is only a beginning.

Chas. H. Cone and Mrs. Cone have come to Chicago after a brief and very sensible little honeymoon trip, and settled down. Charley will hereafter be found at the Knapp electrical works, except, of course, when he is with his new family.

Mr. A. H. Bauer, electrician for the Pullman Company, has inaugurated a secondary battery outfit at the Dearborn depot, and is loading up electricity for use on the L. N. A. & C. R. R. vestibule trains between Chicago and Cincinnati, Indianapolis, Louisville, New Orleans and—hold your breath—the City of Mexico, through, limited, vestibule train from Cincinnati.

Work has been commenced on Chicago's first elevated railway, which is to run up Lake street from the river west. It is confidently believed that this will be an electrical road. Arrangements have been made for a limited number of deadhead tickets as premiums for eastern electrical editors, good in exchange for notices during our World's Fair in 1892.

The Ball Electric Company, Ed. Stockwell, Western agent, has removed from the Tremont House block, and will hereafter be found at 121 Lasalle street, room 35.

Fire Engineers.—At the annual meeting of the National Association of Fire Engineers held at Kansas City, September 10 to 14, the following resolutions were reported and unanmously adopted:

WHEREAS, The present method of overhead wires, carrying high potential currents suitable for arc lights, electric railroads, power, etc., are exceedingly dangerous, especially to firemen when in the discharge of their duties, therefore be it

Resolved, That we urge upon all legislative bodies, both municipal and State, that the only conceded safe method for the transmission of such currents is underground

Resolved, That wherever any overhead method is allowed or tolerated, that every known precaution should be required by suitable laws or ordinances.

Resolved, That the present method of insulation of overhead wires is very imperfect, and however good apparently, deteriorates rapidly after being put up, and is virtually not insulation.

Resolved, That the various fire chiefs throughout the United States should in no manner jeopardize the lives or limbs of the members of their departments, until they have first assured themselves that no currents are passing on such overhead wires, in the immediate proximity of the fire.

Resolved, That the most rigid inspection of wires entering buildings, carrying high potential currents should be had by competent authority, and every precaution taken to prevent any possible contact of such wires with those of telephone and fire alarm wires, water or gas pipes.

Resolved, That we earnestly call upon all municipal and legislative bodies, and urge the necessity of suitable legislation and inspection of the present dangerous system of overhead wires for the purpose of lessening the dangers and evils thereof.

Resolved, That we, the National Association of Fire Engineers in convention assembled, emphatically assert that the only safe method for such currents is underground, and place our most unequivocal condemnation on all overhead or suspended wires, for the reason of its great danger to life as well as to property.

Resolved, That the secretary be instructed to have these resolutions printed and distributed, and the various chiefs to have the same published from time to time in their local papers.

Following the above report, Prof. J. P. Barrett, of Chicago, said:

"I want to say that in the city of Chicago we have some 3,100 or 3,200 arc lights. Every inch of the wire connected with these lamps is underground. The potentiality is as high as 3,500 volts, and there is no difficulty in the working of the wire underground. The only objection is that it costs a little more to put them underground than overhead; and there they are safe."

Insulating Test.—Professor Barrett has awarded contracts for five miles each of the following cables for the new electric light plants: Okonite, Kerite, Patterson, Cobb and Standard. As may readily be supposed, this not only divides up the wiring of the plant, giving all a fair show, but it becomes a test in which the lasting qualities of each of these excellent insulators will speak for themselves.

Mr. Charles H. Wilson, superintendent of the Chicago Telephone Company, was joined in wedlock to Miss Phoebe, daughter of Mr. and Mrs. E. T. Hollister, on the 18th, at the family residence of the bride's parents, St. Louis, Mo. The wedding was a quiet one, the death of the groom's grandmother occurring just previous to the marriage, casting a shade of sadness over the occasion. The deceased had been suffering from a lingering illness many months previous to her demise. Mr. Wilson and his bride have gone West, as far at least as Salt Lake, where they will show the Utah people, by example, that it is positively certain one wife may claim the entire affections of one man. The happy couple will return to Chicago, and take up their residence at St. Caroline's Court Hotel, October 17th.

Chicago, Sept. 28, 1889. C. C. H.

OUR BOSTON LETTER.

Telephone Work in New England.—In a talk with Col. J. N. Keller, general manager of the New England Telephone Company, many interesting facts concerning the work of his company hereabouts were gleaned. Interesting work is being done on Beacon street in this city, where 1,500 feet of vitrified conduit is being laid, the work now being nearly completed. In Kilby street 27 iron ducts are being laid in concrete. The new building of the company is being pushed as fast as good work will allow, and will be ready for occupancy within a year. Outside of the city telephone work is being pushed in all directions. The through line from Boston to North Adams, Mass., along the route of the Fitchburgh railroad, is about complete, and new lines to Gloucester, Mass., and to Concord, N. H., are now in working order. In addition to this work new routes are in process of construction to Lowell and Nashua, and from Boston to Newburyport and Amesbury.

From the Local Westinghouse Office.—Mr. Fred. P. Barnes is now the general district agent of the Westinghouse Company for New England. Mr. Barnes is naturally much pleased with the business done by his company during September, which he tells me amounted to $1,250,000 for electrical apparatus alone, the best month's record in the history of the company. The works of the company are running night and day, and the Sawyer-Man factories are also pressed to the utmost to keep up with orders for lamps and sockets. In a single day last week orders were taken for 20,000 Sawyer-Man lamps.

The Dexter, Me., Brush Plant.—The alternating dynamo which Mr. L. H. Rogers, the special agent of the Brush Company, has just sold to the Dexter, Me., Electric Light and Power Company is one of the new Brush machines about which so much has been said of late, embracing as it does several remarkable features. The armature is stationary, obviating the need of brushes, and the bobbins in the armature may be cut out and the machine run with one, two, three or the whole number. This contract, which calls for a 650-light machine, is keeping up Mr. Rogers' excellent beginning in this part of the country.

The Standard Electric Company.—Mr. L. A. Millbank, manager of the Standard Electric Company, kept my pencil busy on Saturday jotting down installations of lighting plants now under way by his company. Among the firms and companies which have adopted the Standard system are the Chase Turbine Manufacturing Company, of Orange, Mass.; Brown Lumber Company, of Whitefield, N. H.; André Cardinal Silk Mill, Paterson, N. J.; Bennett's Brooklyn Theater, Brooklyn, N. Y., and Parker & Young, Lisbon, N. H.

In a New Position.—Mr. W. A. Carey, formerly in charge of the New England office of the Westinghouse Company, where he left an excellent record, has become special agent for the Thomson-Houston Company, with headquarters at 620 Atlantic avenue.

Work of the Union Electric Car Company.—The Beverly & Danvers Electric Railway, operated on the storage battery system of the Union Electric Car Company, has been completed and cars were run over the route last week. The trial trips were made Friday and resulted perfectly satisfactorily, the car making a trip over the entire road from Beverly to Danversport, a distance of three miles, in 22 minutes, and the return in 18 minutes, although the run was not intended as a speed trial. The line is hilly throughout, in some places the grade reaching eight per cent. The road will be opened to the public next week. In this road the company has introduced the electrical and mechanical improvements which were tried in Boston last year, but advantage has been taken of additional experience in actual operation. The annual meeting of the company was held on Sept. 25, and the following officers were elected: President, Hon. Linus M. Child; vice-president, J. H. Alley; secretary and treasurer, Andrew Robeson; general manager, Col. E. H. Hewins; electrician, Wm. L. Stevens; directors, Linus M. Child, J. H. Alley, Andrew Robeson, E. H. Hewins, A. L. Richards, Julius E. Rugg and George H. Drew.

Opening the Lecture Season.—Mr. Alex. P. Wright will give the first of a series of electrical papers to be read before the Electric Club this winter. His subject will be "Underground Electrical Work," and the exact date of the meeting is not determined. The place will be the club rooms in Park street.

Dedication of a New Plant.—The Andover Electric Company celebrated the opening of its electric light station Wednesday evening, September 25th, by a clam bake. There were about 400 citizens of the town present, including the board of selectmen, the band, Ballardvale drum corps, the fire department and heads of the town departments. There were also present representatives of a great many gas and electric companies, and the occasion was a very enjoyable one and at the same time very novel, from the fact that a genuine clam bake was gotten up and served some 30 miles from the sea shore. The station of the company is of brick and about 80x50 feet. It has at present two Taylor engines of 100 horse power each, with two 125 horse power boilers. The steam plant was furnished by Geo. F. Holt, of Boston, and the electrical outfit will consist of two 50 light Thomson-Houston arc dynamos and two 650 alternating current incandescent dynamos. The company started off with a nice street lighting contract of 12 years, and have now about 1,000 incandescent lights wired up in stores and dwellings. This company also controls the right for the manufacture and sales of gas in the town. The stock of the company has been taken in the town and will be immediately increased to cover additions contemplated to the plant, the new stock being nearly all pledged to Andover people.

Business Notes.—Mr. R. T. White, of Pearl street, is at work getting out a new pattern of rail chair for electric street railways, which he has christened the "daisy." This pattern and a new fastening have been adopted by the Newton Electric Railway Company, and in preparation for orders Mr. White has arranged for a production of rail chairs reaching up into the thousands daily.—The Wright Engineering Company have taken a contract for the work to be done in Woburn, where an increase of 32 lights is ordered, and for lighting Winchester, current on the alternating system to be applied from Woburn. Ten miles of wire is being put up by the same company for the 75 arc plant at Danielson, Conn.—H. N. Bates & Co., of Pearl street, are installing friction clutches in the Camden, Me., electric light station; for the Wamsutta Mills at New Bedford, and for the Lowell Electric Light Company's addition. Orders ahead for clutches keep the firm working to their fullest capacity. T. W. S.

Boston, Sept. 30, 1889.

OUR WASHINGTON LETTER.

Recognizing Electricity.—The superintendent of the census has appointed Mr. A. R. Foote, of Cincinnati, an expert to make an investigation of the electrical industry for the 11th census. This is a most excellent appointment and will give universal satisfaction.

A Telegrapher in Trouble.—On the 13th inst. there was a collision on the tracks of the Baltimore and Potomac R. R., near the Navy Yard, by which engineer James Jamison lost his life. The coroner's jury presented Mr. E. H. Kramer, the telegraph operator, as having by negligence been the cause of Mr. Jamison's death. Bail in the sum of $1,000 was given for Mr. Kramer's appearance. There has been a feeling throughout this sad affair that Mr. Kramer was not to blame, and a confidence that he will be vindicated by the court.

The World's Fair.—I see that some of your correspondents are speaking of locating the site of the World's Fair of 1892. Now, if any of these people come to Washington I will show them the site of the coming Exposition. It is no use talking, gentlemen, the Capital City wants that Fair badly, and here it is coming.

Washington, Sept. 27, 1889. G. E. M.

The Association of Sprague motor agents will hold their semi-annual convention at the Weddell House, Cleveland, Ohio, on Tuesday, October 8, 1889.

OUR KANSAS CITY LETTER.

Electric Railways.—Although Kansas City has made rapid strides in cable railways in the past five years, and to-day has more miles of cable road than any city in the world, she has only lately arrived at the conclusion that for motive power in street railways, electricity is unsurpassed, and she is now the proud possessor of four miles of electric railway in operation and 11 miles under construction. The first road completed was the Armourdale line, which displaced the old mule line, and to-day the trip can be made over the entire road in 20 minutes, while the old way it took *any* length of time, according to the feelings of the mules and driver. The road is now operating five cars, one 80 horse-power generator being used, which is located in the power house of the Metropolitan Railway Company, on West Ninth street. The Ivanhoe Park Railway is about completed, and on the arrival of the cars, six in number, it will be put in operation. The cars are equipped with double motor trucks. One 100 horse-power generator will be placed in the power house at Lynn and Highland avenues. The Northeast Street Railway, which will be completed about Jan. 1st, 1890, will be the longest of the three roads. Three 80 horse-power generators and 10 cars, equipped with double motor trucks, will be used in operating it. This will give the city a total of 15 miles of electric road. The T.-H. system is used on all of the roads. The electric work on the Armourdale line was done by the T.-H. Company, the work on the others by the Western Electric Construction Company, of this city.

Personal.—Mr. J. H. Reid, the Western manager of the Mather Electric Company, was in the city yesterday in the interest of his company. Mr. W. H. McKinlock, of the Central Electric Company, was another recent Chicago visitor here.

Fort Scott, Kansas.—Mr. C. S. Rusling, of the Thomson-Houston Company, reports the sale of two 35-light arc machines to the Fort Scott Electric Light and Power Company.

Fire Alarm System.—There has been considerable controversy between the board of underwriters, which met at Excelsior Springs, Mo., on Tuesday, and the fire department, of Kansas City, as to the mode of fire alarms used here. The board claims that the telephone system as used here in cases of fire is inefficient, and even claims that Chief Hale, who is the patentee of the Hale fire alarm telephone system, has made the matter one of personal benefit in advising the use of the telephone for alarms.

From the past service of the fire department and its quick response to all fires, I should judge that an efficient fire alarm system is in use and I know of no other than the telephone. D.

Kansas City, Mo., Sept. 27.

PERSONAL.

Mr. Thomas A. Edison sailed from Havre for New York on Saturday last, and will arrive here next Sunday.

Lieut. F. W. Toppan, U. S. N., has returned from an extended visit to the Paris Exposition, where he saw many things to interest and attract his artistic eye.

Mr. F. N. Bossons, of the Thomson-Houston Company, the energetic gentleman who had so much to do with the success of the electrical exhibition at the Chicago Electric Light Convention, is looking into electrical matters in this city.

Mr. H. Hollerith, of Washington, D. C., a well known member of the Electric Club, has been awarded a gold medal at the Paris Exposition for his tabulating system, which was illustrated in the ELECTRICAL REVIEW last January. This system is a very valuable one and will, no doubt, be adopted for use in the coming census report.

Mr. Geo. M. Bailey, of Buffalo, N. Y., who represents a large number of electrical exhibitors at the Paris Exposition, will return to Paris October 5th, to remain until the Exposition closes. Mr. Bailey was in Paris from the opening of the Exposition until a short time ago, when he returned for a few weeks rest at his home in this State.

Mr. Paul H. Brangs, formerly of the United States Electric Light Company, Newark, has accepted the position of electrician with the Delaware, Lackawanna and Western R. R., and will in a short time start a plant of 1,000 lights in the Hoboken passenger depot, using the Edison system. Mr. Brangs was very popular with the employés of the Newark factory, and before leaving was presented with a beautiful silver tea service by his fellow-employés.

Telephonic News

⁂ Denver and Leadville, Colo., are now connected by telephone.

⁂ The Bell Telephone Company adds another to the long and almost uninterrupted list of its legal victories by the decision of the Circuit Court at Boston, permitting it to file a new plea and answer to the Government's suit against it.

⁂ Akron, Ohio, adopted the conduit system nearly two years ago, and with the most flattering success. It may not be generally known, but it is a fact that telephone subscribers of Akron are talking through conduits day after day.

⁂ The Western Electric Company, of Chicago, filed a suit a few days ago in the United States Circuit Court against the St. Louis Express and Messenger Company, of this city, for the infringement of a patent. The petition alleges that one Stephen D. Field was the original and first inventor of certain new and useful improvements in district telegraph signal boxes, and that he secured letters patent on his discovery April 17th, 1877. The plaintiff claims to have secured this patent by purchase from the inventor, and that the defendant is now making, using and selling without authority such district telegraph signal boxes. An injunction is asked against defendants.

⁂ Superintendent E. B. Baker, of the Southern New England Telephone Company, has been granted a patent, which, when put into use, will do away with much danger by electric light wires and lightning. It will aid to avert such disasters as was recently caused by the fire which two weeks ago ruined the Yale Bank building and caused a loss of $17,000. The invention is a novel connecting device comprising, in a single structure, the box-shaped terminal head, which is to be placed on a pole out of harm's way, binding posts for terminal wires, both cable and local, and removable safety fuses, all of which occupy little space and can be quickly placed in position and changed about. Besides being a great saving to electricians in compactness, it is efficient in warding off lightning and electric currents where they can do no harm. This terminal head can be fitted out in a factory and needs nothing but connecting of wires to the binding posts to make it effective. It is a unique invention, and is but one of the numerous contrivances that Mr. Baker has, as an electrician, perfected for the advance of telegraph and telephone service.

⁂ The following was furnished for publication a few days ago from the executive office of the Southern New England Telephone Company: "The subscribers of the Southern New England Telephone Company do not fully realize the extent of damage and enormous amount of work to the company which followed in consequence of the recent fire in the Yale Bank building. The company had 16 lead covered cables running into the cupola of its old quarters, all of which were burned free from their fastenings and the connections entirely destroyed. Each of these 16 cables contained 50 wires, making a total of 800 wires, fused into a tangled and confused mass. As each of these wires carried from one to five subscribers, the cessation of all telephone service was, of course, complete. To complicate matters, the record of these cables, with their wire numbers, was destroyed, and in order to renew connections and restore the service it was necessary to bring each of the 16 cables into the new office through different streets and test each one. The method employed in doing this was to ring some number on each wire in every cable, ascertain who the answering party was, refer to the directory and then make the proper connection into the switchboard."

⁂ The National Telephone Company, Limited, of London, have an interesting and tastily-arranged show at the Birmingham Electrical Exhibition. Their space has been divided into three compartments, the front one being devoted to the display of various forms of telephonic apparatus at present in use, whilst the two back ones are set apart to illustrate a telephonic exchange in operation, and for the purpose of enabling visitors to test the long trunk lines now existing from the great midland metropolis to various towns both north and south.

⁂ The directors of the Western Union Telegraph Company have declared a dividend of one and a quarter per cent. upon its capital stock for the quarter ending Sept. 30. The company began the quarter on July 1 with a surplus of $8,611,401.78. The net revenues for the quarter (estimating the September business) are placed at $1,750,000, which, with the surplus, gives $10,361,401.78. Appropriations from this amount, including interest on bonds and sinking funds, reduce it to $10,151,401.78, out of which the current dividend, $1,077,385.38 comes, leaving a surplus at the end of the quarter of $9,074,016.40, an increase of $462,614.62.

Broken Ocean Cables.

It is stated that the Western Union cables, extending from Ireland to Nova Scotia, are both broken. They have parted somewhere in the depths of mid-ocean, and sometime next month what is known as a cable steamer will steam out to the location on the surface of the mighty deep, somewhere beneath which the rupture has occurred, will haul up the broken ends, splice the four ends into two cables once more and electrical communication between the two countries over these lines will be restored. Then the cable steamer will leave the spot, unmarked in all that vast area of water, save by reference to the stars above and to the sun, and will sail back to the port where she belongs.

These two cables, it may be explained, are two of the seven cables comprising what is known as the Gable Pool. Of the remaining five cables four are owned by the Anglo-American Company, whose headquarters and whose offices are in England, and the fifth cable is the Direct Cable also owned by Englishmen. These seven cables, the property of three companies, pool their earnings under a contract which has been in existence for several years, and divide them according to certain percentages which were fixed at the time of the contract. When one, or even two, of the cables breaks, as is the case at present, the other cables in the pool do the extra work thus entailed on them, and the gross earnings are divided up just the same as though nothing had happened. As five cables are quite enough to do all the cable business done at present the cable messages suffer no delay, and the only thing the company has to do whose cable or cables are broken is to make the repairs within a year, because if they are delayed beyond that time the existing contract would be abrogated.

Our esteemed contemporary, the New York *World*, makes the following interesting remarks on the situation: "The idea of the broken ends of these cables, lying hundreds of fathoms deep beneath the track of passing vessels and hundreds of miles away from land on either side, appeals in a peculiar way to the ordinary imagination; and it appeals to the imagination of any one who knows fairly well what the bottom of the ocean is like more strongly still than it does to a person who has a prevailing notion that the bottom of the ocean is all sand and extends pretty much like a billiard table from one continent to the other. But fancy for a moment a cable strung across the mountains of this continent and dropping into the valleys by sheer force of its own weight; falling from the pinnacle of Mount Washington and trailing across the Hudson River, climbing the Alleghanies and the mountains of Tennessee and dropping thence into the valley of the Mississippi, winding across the plains and climbing the Rocky Mountains on the way to San Francisco, and then flood this immense area with a mighty ocean and a practically faithful picture of a deep sea cable is presented. Starting from land on the other side these Gould cables descend into the valleys, reach up to the tops of the hills, turn and twist and go around and climb across; and fathoms and fathoms above them the waves break themselves against each other and storms lash the waters into fury, or the sunshine spreads them out serene and placid as a mirror. And it is the picture of these broken cables, broken half way down a hill or buried in the sands half way across the valley, that captivates the fancy and makes one wonder over the science of man which enables him to pick up those ends from the mysterious depths of ocean and put them together again.

"The location of a cable break is very accurately determined by a process known to electricians and by an instrument which discloses how far an electrical current, started on a given line of wire, travels before it meets with interruption. The calculation of the distance to the break made on this side the Atlantic can be checked and confirmed by a similar calculation made on the other side, although such a confirmation is scarcely necessary. After having found out how far from land the break is, the only other thing the captain or navigator of the cable steamer wants to know is in what direction that distance is to be travelled; and as the course of the cable is perfectly well known from the fact that when the cable was laid accurate observations were taken by the cable layers and records made, the cable steamer starting out to do the repairs can steam directly over the spot where the break is located.

"Of course when this statement is made it is not at all meant that the location can be determined within a few inches or a few

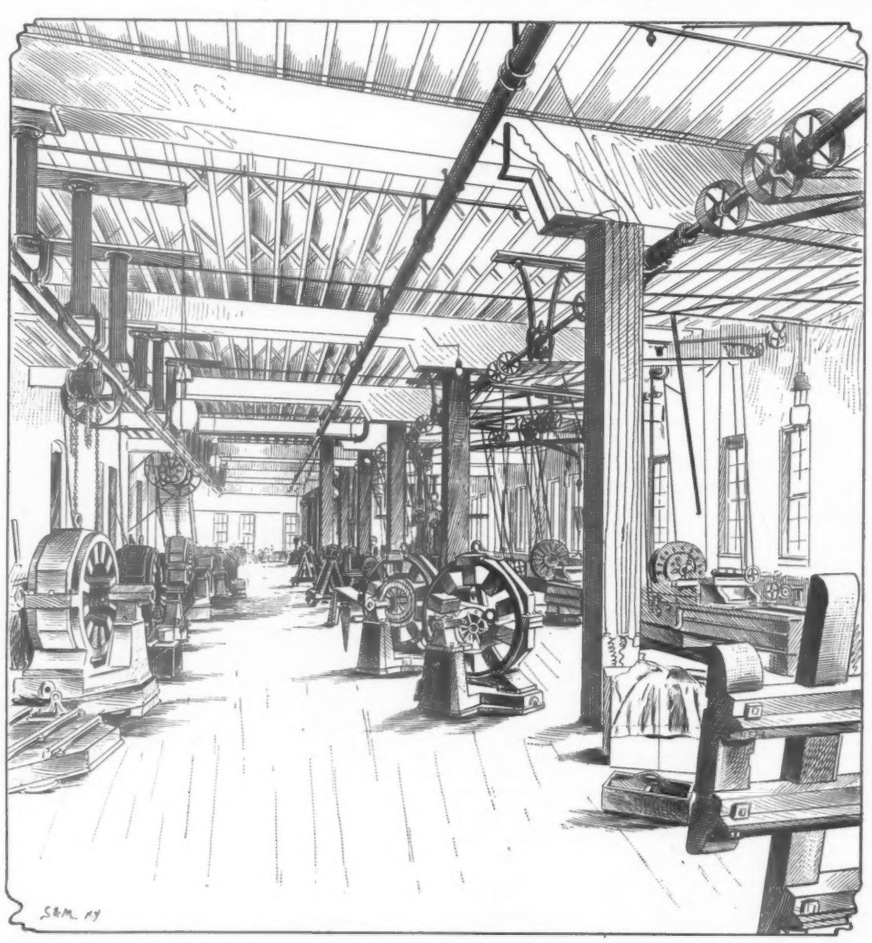


FIG. 2—VIEW OF THE LARGE MACHINE SHOP OF THE FORT WAYNE ELECTRIC COMPANY, FORT WAYNE, IND.

A New Electric Clock.

The New Haven Clock Company, after a year or two of experiment, are now manufacturing and about to put on the market a self-winding clock. The motive power is furnished by electricity generated by two Leclanche cells which do the work effectually for from 12 to 18 months without renewal. Much of the ordinary clock is omitted, and little remains save the escapement wheel. The clock is wound every hour by a current from the two cells of the battery working through a pair of magnets. The main wheel, which revolves once an hour, connects the current at every revolution. When the contact is first made and the current passes through the magnets the armature is pulled down to the magnet heads, drawing with it an arm which winds one tooth of the ratchet wheel which is fastened to the box containing a spring of the finest steel attached to the center pinion. This operation is repeated for five or ten seconds at the rate of three blows a second until the spring is wound and the current is cut off by the passage around of the main wheel.

feet, but it can be determined within a very limited area, so that the grappling for the ends of the cable does not usually extend in good weather over a period greater than two or three days, and sometimes does not last even so long as that.

"The grappling-irons are immense affairs, attached themselves to cables manipulated from the deck of the steamer, and are plunged downward and dragged over the bottom of the ocean. When the cable is finally grappled the fact is made clear at the steamer end of the line by reason of the strain to which the grappling-iron is subjected, precisely as a fisherman known that he has a fish on his hook by the increased tautness of the line. The only difference is that in the case of the grappling-iron the strain is revealed by an instrument on board the steamer known as a dynamometer. When this instrument reveals the presence of such a strain as the grappling of the cable would bring about, the iron is hauled up with the cable at the end of it.

"The repairers always calculate to grapple the cable about ten miles away from the point at which the break has occurred. If the irons grappled the cable too near the end, the cable would slip away long before it reached the deck of the steamer. In some instances no break has occurred at all, and electrical communication has been interrupted perhaps by the destruction of the insulated covering of the cable, or by some defect of a similar character, so that when the grappling-iron appears at the surface of the water, the entire length of cable comes up with it. The break is then spliced, or the defects remedied, and the rehabilitated cable is consigned once more to the bosom of the mighty deep. Of course many times it is not possible to determine exactly what the cause of a cable break has been, but usually the trouble is that the cable has been laid too taut, and it has broken or been damaged in a serious way by reason of the immense strain resulting on this excessive tautness. The consequence is, that whenever a repair is made in mid-ocean, the repairers cut away all the twisted and strained cable in the immediate neighborhood of the break, and do away with all possibility of tautness by putting in 25 to 50 miles of new cable. This may meander down the side of a submerged Mount Washington, or may curl quietly up in the basin of a Mohawk Valley, but whatever it does, there is no chance of the cable breaking in that particular spot again from being drawn too tight.

"Outside of this, cables are frequently damaged by the anchors of vessels, fishing vessels chiefly, which anchor for the purpose of carrying on their fishing. Accidents of this kind occur of course near the shore or on the banks of Newfoundland. The anchor becomes entangled with the cable, and, rather than spend the time necessary to get it free, the cable is dragged up and cut and the vessel proceeds on its way. Simply to avoid a little trouble the captain of a fishing vessel will put a cable company in for thousands of dollars of expense. The situation is recognized by the cable companies, and they have a standing offer to indemnify any vessel for the loss of an anchor, and they pay out large sums of money every year on this score. It will be seen that there is no possibility of verifying such claims, and the consequence is that false claims for damages have undoubtedly been put in and unscrupulous captains have collected money for anchors which were never lost.

"Another source of trouble to the cables are the icebergs. These icebergs floating down from the arctic seas frequently extend beneath the surface of the ocean for many hundreds of fathoms, and the base of the passing iceberg catching the cable bears it onward and finally snaps it in two. The bottom of the ocean varies in depth in a very marvellous way, right in the path these icebergs usually take. Off the banks of Newfoundland the bottom is reached sometimes at so inconsiderable a depth as 75 to 100 fathoms. What this distance is may be estimated when it is stated that, roughly speaking, there are 1,000 fathoms to the mile. But from the point where the depth is 100 fathoms the ocean bottom goes down the side of a mountain to 2,500 fathoms, or two miles and a half, within a very short distance. Perhaps the bottom rises up again and the cable hangs between the two submerged mountain tops, and the iceberg coming along quietly picks up the loop thus formed and carries it onward until the strain results in an absolute rupture.

"There are stories of cables having been injured by whales and other monsters of the deep, but these interesting tales are to be taken with a good deal of allowance. One tale is to the effect, and it is a tale in more senses than one, that when a faulty cable was once dragged on deck the decomposed body of a whale was found within the twisted and convoluted cable, and electrical communication had been interrupted because the cable had got around the whale and the whale had got around the cable. This Munchausen story may be true, but it cannot be verified. Another fairy tale which has attained limited circulation is that a mid-ocean cable was attacked by a sword-fish, the sword-fish laboring possibly under the impression that the cable was an elongated eel, and the result of the attack was that the cable was peeled of its outer covering and the bare wires were left to the mercy of the immediate and watery surroundings. The illustration printed herewith of a damaged cable shows what picturesque damage an able-bodied anchor can do when the cable and the anchor become too familiar.

"All the cable companies regard cable breaks as a part and parcel of their legitimate business. They are never surprised when a misfortune of this kind overtakes them, and so far as financial considerations are concerned, they are always prepared for it. Indeed, all the companies put away so many thousand dollars every year to pay for anticipated breaks of this character, so that the money which goes for repairs does not come, so to speak, directly out of the treasury. It has already been appropriated for the purpose to which it is applied. The only break which the cable people really dread is the break which occurs not in mid-ocean but in mid-winter. It is quite obvious that the repairing of a deep-sea cable, when the waves are rolling mountains high and storms invest the heavens from horizon to horizon, is no easy task, and under these circumstances grappling for a cable is something very difficult of accomplishment. In the summer though, and particularly in October, after the equinoctial storms, when the skies are serene and the surface of the ocean frequently as placid as the surface of an inland lake, the matter of repairing the breaking of a cable, unless indeed it interferes seriously with business, is not regarded in so serious a light.

"The cable buoy is used in repairing cables if the break happens in winter time and a storm comes up and begins to hustle the steamer around in such a way that it isn't possible to keep the end of the restive cable on board. At such a time as this the cable is attached to the cable buoy and the buoy is thrown overboard. When the weather subsides the cable is easily recovered and the splicing is done. Of course as soon as the cable is found communication is established between the steamer and the cable station on one or the other side of the Atlantic. If the communication between the steamer and Ireland is all right, for example, it is known that the cable is uninjured between those two points, and when this has been determined the repairing goes on until the American side of the ocean and the steamer are brought into electrical contact. It may be mentioned that in grappling for a cable with the grappling-iron, a sketch of which is here given, the steamer proceeds in a course exactly at right angles to the cable, so that the cable is usually caught within a comparatively short time.

"Of course the cost of repairing a cable is very considerable. When it is considered that a fully equipped ocean steamer, with an expert navigator and expert electricians on board, is devoted exclusively to the business of repairing the cable for a length of time extending anywhere from two weeks to a month, some idea of the cost may be arrived at. The Commercial Cable people have their own steamer, which represents an investment of several hundred thousand dollars, and the officers and electricians are on the pay-roll of the company from one year's end to the other. The Anglo-American Company, which owns four cables in the pool, also has a cable steamer, called the 'Minia.' The Western Union people have no steamer of their own, and when they need a steamer hire either the 'Minia' from their associates in the pool or the 'Faraday,' which is owned by the Sieman Brothers, of England, who maintain the 'Faraday' because they are cable manufacturers and use the steamer as a general thing for laying new cables. When the 'Minia' is hired out its owners charge $800 a day for it, and when the Sieman Brothers have the 'Faraday' at liberty their daily rental is $1,200.

"As three weeks is perhaps an average time required for the proper repair of an ordinary cable break, it will be seen that the mere rent of the steamer amounts to about $25,000. To this is to be added, of course, the actual cost of the repairs and the 25 or 50 miles of new cable. And cable, if it were sold by the yard, would be sold almost at the price of fine lace. The two cables which the Western Union intends laying from Nova Scotia down into New York Bay, a distance of 840 miles, will cost, with the laying, about $1,000,000, and presumably the cost of laying bears the same relation to the cost of the cable as the cost of carpet laying does to the price paid for the carpet. Some cable breaks have probably cost $100,000, but it will be seen that the cost is entirely dependent on conditions which cannot be foreseen and cannot be controlled. A foggy day with the 'Faraday' in commission means an absolute expenditure of $1,200, and a week of foggy days will bring this up nearly to $10,000, both from the fact that observations cannot be taken in bad weather, and from the fact also that successful grappling cannot be conducted when the surface of the ocean is disturbed unduly by storms; clear, bright weather is almost absolutely essential to the prosecution of repairs.

"The finding and repairing of the original Field cable is probably the most remarkable triumph in the whole annals of the science of navigation. When that first Field cable was laid nobody knew as much about cable-laying as they have since found out, and no particular or especial pains were taken to record the exact course of the steamer and consequently the location of the cable. It parted in mid-ocean and for five years no attempt was ever made to do anything with it. At the end of that time and after a second and more successful cable had been laid, the 'Faraday' steamed out on the trackless ocean to pick that cable up, did pick it up, spliced it and finished successfully the job of laying it. Here certainly the difficulties in the way seemed overwhelming. The only thing the searchers had to guide them in their search was the log of the steamship 'Great Eastern,' which made known the course of the vessel certainly, but not with the extreme accuracy which was in such a case every way desirable. More than that, the cable had lain at the bottom of the ocean for five years, and probably the grappling irons passed over it a number of times before they finally grappled it. When it was got hold of it was incrusted with all manner of ocean growths, and Cyrus W. Field is said to have a piece of it about a yard long covered with coral. When this successful achievement is considered, the work of finding and repairing a cable, where the break is known to be a certain number of miles from the land and the original course of the cable is a matter of accurate knowledge, dwindles into comparative insignificance.

"The 'Faraday,' which will lay the new cables, is expected to leave the other side about October 1, and to reach Canso, in Nova Scotia, where the cable terminals are located, early in the second week of October. How long it will take the 'Faraday' to lay the two new cables from Nova Scotia down to New York depends entirely on the weather. Under ordinary conditions the steamship would pay out about eight knots of cable an hour and reach here in four or five days after leaving Nova Scotia. On the other hand, if the weather is foggy and the 'Faraday' meets with any mishap, the trip may be prolonged for a matter of two or three weeks. The Western Union people have acquired a landing for the cable at Manhattan Beach, near the Oriental Hotel and not far from the landing of the Mackay cable. A plot of ground 100 feet front and 150 deep has been acquired and the necessary buildings will be at once erected."

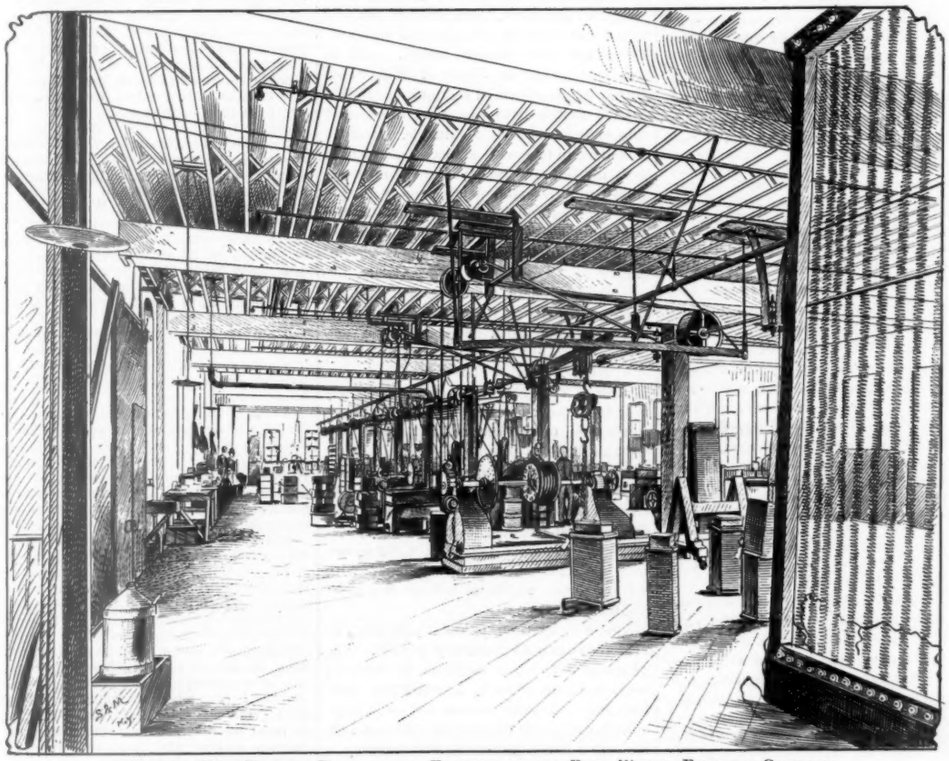


FIG. 4.—THE WINDING ROOM IN THE FACTORY OF THE FORT WAYNE ELECTRIC COMPANY.

.... The French cable, now connecting at North Eastman, will be landed at Rockport, Mass., in a few weeks. It will be run into the cable house at Cape Hedge; and new instruments will be put into the Commercial Cable Co.'s office, the companies having combined.

.... The Great Northwestern Telegraph Company, Montreal, Canada, has served upon the secretary of the Montreal Telegraph Company an incidental demand claiming a further reduction of two per cent. in addition to the two per cent. already asked by the action taken. The Montreal company claims that there is no evidence yet to warrant such an application.

.... The Central and South American Telegraph Company has declared a dividend of 1¾ per cent., payable October 5th to stockholders of September 28th. It makes this statement: Surplus July 6th, $464,114; receipts for three months to September 30th, $145,551; total, $609,665; operating expenses, $36,000; balance, $573,665; dividend October 5th, $70,115; balance, $503,549; addition to surplus for the quarter, $39,535; per cent. earned on outstanding stock, about 2¾.

* * The Thomson-Houston Welding Company will shortly commence on the erection of a new factory in Lynn. The building will be 200 feet long and 100 feet wide.

* * The Willamette Heights Railway Company, of Portland, Ore., has applied for a franchise for an electric road three miles long, from First and Oak streets to Willamette Heights.

* * The electric street railway company which is to construct a road between St. Paul and Minneapolis, Minn., has a capital of about $3,000,000 The Thomson-Houston system will be used.

* * The complete consolidation of the Des Moines street railway companies at Des Moines, Ia., will be effected about October 1st. Many useless tracks will be taken up and electrical power will be used on all the lines, the system radiating from the center of the city.

* * The Edison machine works at Schenectady, N. Y., have broken ground for three large buildings to be erected adjoining their present establishment, the total cost of which will be $105,000. The works have been a valuable addition to Schenectady's industries and now employ 1,300 men.

* * The Connolly Motor Company is going to build a factory at Elizabeth, N. J., for the manufacture of its motors. It has secured a location for the buildings on Fourth avenue and will at once begin their erection. Connection with the railroad will be made by a branch track through Florida or Erie street. The factory buildings will front on the Elizabeth river.

* * The Newburyport Car Company, Newburyport, Mass., is building an experimental electric car. It is nearly double the length of the ordinary box car, and is to be run on six wheels. In running on curves the driver, by means of a patent attachment, can raise the forward and rear wheels clear from the track, so that the car will round the curve on the middle wheels.

* * The Globe Electric and Power Company, St Joseph, Mo., having consolidated with the Union Street Railway Company, the consolidated company will prepare to extend its business and later in the season they will probably put in another plant in another part of the city, so as to operate one portion of the city from one plant and another one from another. They will not go extensively into electric heating this season, but will heat one car to show what can be done in that way.

* * The Thomson-Houston Company, of Boston, Mass., has secured a contract, second only in importance to the West End contract, covering the entire cities of St. Paul and Minneapolis, with electric road between the two cities, which has for a long time been regarded as one of the most important electric railroad projects in the country. A large contract has also been executed with the Denver Tramway Company, of Denver, Col., and also a very important one with Milwaukee, Wis., covering a large portion of the business of that city.

* * A Brazilian inventor, to whom a patent has just been issued, proposes to remedy the annoyance suffered from the shaking of dishes upon the tables on shipboard by means of an electric contrivance. His idea is to use an electro-magnetic device. To the under side of the dishes will be attached small pieces of iron, and on the table will be laid long strips of soft iron to which wires leading to a battery will be connected. The use of this electro-magnetic appliance will not mar the appearance of the tables, and certainly it should prove effective.

A Correction.

To the Editor of Electrical Review:

Dear Sir.—In your publication of September 21st, in a brief article, you state that a singular accident occurred wherein a horse of Doctor Hand was killed and that gentleman himself severely shocked by a telephone wire dropping across an uninsulated guy wire of the People's Street Railway Company.

I wish that you would kindly correct this error, inasmuch as none of the guy wires of the People's Street Railway Company, as can be demonstrated to any one who cares to investigate it, are uninsulated, and that the gentleman himself, to whom this accident occurred, has stated that the telephone wire was in contact with an electric light wire—not with a wire of the People's Street Railway Company, and from that he received the shock.

I desire to call your especial attention to this for the reason that your article has provoked many unjust criticisms of the electric overhead system, as well as stimulated the prejudiced minds of those who claim that the overhead street railway wires are a menace to life. Yours very truly,

Lathrop R. Bacon, President.
New York, September 23d, 1889.

* * Work on the electric railway apparatus for the Florence and Fiesole has been commenced upon at Schenectady, N. Y., and will be ready for shipment before long. This road will be operated entirely by electric power, and Sprague electric cars will be used throughout the entire line. The road connects the city of Florence with the city of Fiesole, a distance of about five miles. The grades upon this line will be very severe, sufficiently so, to have precluded the use of horses upon this line. The fact that American railway apparatus has been adopted on this line is flattering to the company to whom the order is given.

* * During the last week there have been a number of street railway companies which have contracted for electric railway apparatus in spite of the lateness of the season. The latest contracts closed by the Sprague Electric Railway and Motor Company, of New York, are for street railways in Piqua, Ohio, and South Nashville, Tenn. The road at Piqua is an entirely new road, never having been operated by any power before. The number of cars which will be equipped will be four, and the line will extend for a few miles on the main streets of Piqua. The South Nashville Street Railway Company will equip eight cars at present, but it is expected that the entire road will be run by electric power before long.

* * Detroit is becoming very well supplied with various kinds of electrical companies. Recently the Short Electric Railway Company was incorporated with a capital of $1,000,000, of which $500,000 is paid in. The company will engage in building and equipping railways designed to be operated by electricity as well as all kinds of railway apparatus, cars and appliances. The stockholders are Sidney H. Short, 6,250; James I. Tracy, 25; George W. Stockley, 25; Charles F. Brush, 25; Jonathan Potter, 25; the Brush Electric Light Company, of Cleveland, O., 37,150; Wells W. Leggett, Detroit, 250, and Nathan B. Abbott, Columbus, O., 6,250.

* * At Cincinnati, the new line of electric cars, recently installed by the Daft Company, runs for a short distance over the Gilbert avenue cable line. Just in front of the power house the cable, which is in two divisions, ends, and for a short distance the trains of two cars passing this point have to release their grip from one cable and travel by momentum alone until they take hold upon the other. As it frequently happens that the momentum of the train is not sufficient to carry it across, a winding drum with a cable attached has been placed at the point of division and is used to bridge the gap. Recently a car was sent out with a new grip which was a little too large, and upon arriving at the point referred to the grip jammed in the slot. The winding cable was attached and the drum started, but the car did not move. While preparing for another trial one of the electric cars came along, and with no very apparent effort pushed the cable car in front of it until it could take hold upon the cable. This was done on a slippery track, and is a very clear demonstration of the case with which the electric motor encounters difficulties, and the large reserve force, so useful in emergencies, which it possesses.

Protection Against Lightning.

To the Editor of Electrical Review:

An audacious thunderbolt struck the Harvard physical laboratory lately, and a call is made for competent men to devise a method of protecting life and property from lightning strokes. Since the failure of the system installed at the Hotel de Ville, Brussels, which was considered the best and most scientifically protected establishment in the world, one hardly knows, as long as the cause of that failure remains unknown, where to turn to find a man equal to the task.

In the broad domain of electrical science there is no ground more uncertain than that portion of it known under the term atmospheric electricity. It is ground too that since the day of Franklin's immortal experiment, down through a century of phenomenal progress in physical science, has been trodden by all the great men whose names stand highest on the roll of teachers and masters of natural knowledge; great men whose figures illuminate the halls of science and decorate the thoroughfares of all our large cities. Looking over this ground, over shadowed as it is to more than twilight darkness by their very greatness, groping one's way and afraid of one's own voice like many a student from the days of Newton until long after Hughen's, there appears but one bright spot to which one can point with confidence and show positive results. And on that spot stands the figure of Wm. Snow Harris, whose system of lightning protection for the British navy has stood the test of time and proved itself invaluable. Here we come face to face with a success as splendid as it mysterious. Surely there is mystery, surely some essential detail, some principle or law of nature has been included in the system used at sea which has not been followed on land. This seems an obvious conclusion.

A description of these systems, both in theory and practice, may enable us to point out why the uniform one-man system succeeds at sea while the multiform land shark system fails. Harris's plan is simple enough. It consists of a narrow strip of copper running from the truck, the highest point of the ship's mast, to the keelson, and connecting with all the bolts passing through the ship's bottom to the copper sheathing and the sea on the outside. This strip of copper is continuous and connects with a plate which on a ship, say 150 feet long and drawing 16 feet of water, measures 150x16x2, 4,800 square feet. This plate is in constant contact with the sea water, which, as a fluid, is a good conductor.

The rod used on land is variously and very frequently disgracefully jointed. The ground connection is made in all sorts of ways and quite often in a criminally careless way. I have seen a rod on a large church edifice put to earth by drilling a hole through a brick pavement and running a few inches of rod into it. But assuming the joints to be perfect and the rod put to earth according to the recommendations of the French Academy of Sciences or Prof. Henry; that is by running the rod into a hole six or seven feet deep and surrounding it with ashes in moist earth, or by running it to a convenient well of water, there is still an enormous difference, for the earth is a conductor only in virtue of the moisture it contains; pure water as compared with sea water is a poor conductor, about one to 3,000, and the surface of the metal in contact with earth and sea is as one to 5,000.

It was well known to the old telegraphers and the physical electricians that the value of an earth plate depended entirely upon the size of the plates in contact with moist earth. When the mathematical fellows came along they formulated this experience and said, "The value of the earth connection is as the active area of the plates without regard to the distance between them." In telegraphy the gas and water pipes are used, but sometimes and in all places where these are not available, an earth plate a yard square is used and is generally regarded as a standard in other electrical work. But the quantity of electricity going to earth from any telegraph office is comparatively small, not over 10 to 20 milli-amperes; for as we know the numerous batteries balance one another and it is only the overflow, or when all keys but one are open that any electricity goes to earth. Consequently the plate a yard square is sufficient for electricity of the velocity used in telegraphy.

It is generally believed that the earth conducts electricity from the ground terminal of a wire or rod back to whence it started. The difficulty of this theory led many to regard the earth as a reservoir for electricity. But one theory is as difficult as the other. The earth has its one natural share of electricity and retains it except when it is carried off as dust, etc., by winds and other forces. The law of gravity quietly restores this in course of time, but some unknown force, the cause of lightning strokes, returns it to earth before gravity has had time to act. But there is no more need of a circuit in this case than there is in the case of stream of light from the sun.

I have stated elsewhere and some years ago that electricity was a concomitant of matter and inseparable from it, that the quantity of electricity which a body contained was indicated by its "specific resistance" and that conversely the resistance was a measure of the quantity. Putting aside this assumption of mine and accepting the "modern view of electricity" as the true theory, there does not appear any reason why I should change my opinion as to concomitancy or as to the roll of the earth in the circuit or the reservoir theory. On the contrary the modern view rather supports it, for there is still some special relation between the ether and all conductors of electricity. Either it is an inseparable accompaniment of the wire or the wire must act like a pipe or tube. If like a pipe then we may properly speak of currents and circuits. But when we speak of a stream of light or heat we do so by a convention; for when the same ether that, when given a peculiar vibratory motion produces electrical phenomena, is by a different vibratory motion producing light or heat, it has no motion of translation and needs no circuit for their production. We have no right then to ascribe to the ether when manifested as electricity a motion which it is not known to possess in its other relations as light or heat; nor have we any right to revive Young's hypothesis and say the ether passes through the earth like the wind through a forrest.

From these and other considerations it seems reasonable to conclude that the "specific resistance" of any conductor is a measure of the quantity of electricity which it contains.

A copper wire one millimetre square, about No. 20, will develop an ampere without much loss from heat. Taking this as a standard or unity it seems plain that not to lessen its value as a conductor in a circuit we must connect it with an equivalent conductor. Sea water contains 27 parts in 1,000 of common salt; a one per cent. solution of salt has a resistance 30,000,000 times greater than copper, while the resistance of pure water is 50 per cent. higher. Bearing in mind that the earth is a conductor only in virtue of the moisture which it contains it appears that an equivalent conductor of any of these substances when forming part of an electrical circuit should be of very large dimensions, 30 or 40 metres square. Nothing so large has been attempted, if even suggested, in practice except where the pipes in cities are used. The pipes, however, are not available in rural districts where usually the greater damage is done, and they are used only in exceptional cases in the cities.

In protecting the Hotel de Ville, Professor Melsens set up 130 points on the building and connected them all in one grand terminal to the earth. The number of points is suggestive of Dr. Lodge's barb wire system.

But it failed and showed the inadequacy of the earth circuit and reservoir theories as well as the theory that a rod protects a radius equal to twice its height. What the condition of the earth may have been as regards its conductivity when the lightning struck the hotel we need hardly stop to inquire. There is reason to believe that the lightning at Brussels acted just as electricity is well known to do in telegraph and telephone wires in America and on lightning rods everywhere; that is, instead of taking to the earth it followed the metals until it expended its energy in producing heat or light; or, when its course being suddenly arrested by a gap in the conductor it accumulated to a density superior to the resistance and tore its way to exhaustion in the nearest matter; or was lost in streams of vibrating ether dying out as daylight dies after sunset.

Following out this reasoning one is forced to conclude that that the recommendation of the French Academy for terminating lightning rods is puerile, that Faraday's estimate of the quantity of electricity in a flash of lighting, if ever believed, was never provided for, and that because a widely different system was adopted at sea, which included an equivalent conductor properly connected to the rod, Harris's system became a splendid success. D. Flannery.

Memphis, Tenn., September 20, 1889.

The Cincinnati Electric Engine.

Such is the name given by its makers to a very well designed electric motor now coming prominently forward on the market. The machine we illustrate is intended for use on constant current arc light circuits—though the makers also build constant potential motors—and is designed to meet the requirements of a very numerous class of power-users to whom electric power is a forbidden thing on account of the absence of the constant potential circuits in their vicinity. Most of them however are close to arc light circuits, and the Cincinnati electric engine will enable them to enjoy the luxury and economy of electric motors. The machine herewith illustrated is well designed, compact and automatic in regulation. A simple form of centrifugal governor, varied by changes of speed, causes compensating changes of pressure in a set of carbon blocks which constitute a shunt around the field magnet circuit.

At rest the governor shunt is open, and remains practically so until a critical speed is reached, when the arms force the carbon blocks together more or less, thus variably shunting the field current, and tending to maintain constant speed with all loads within the capacity of the motor.

The makers issue a concise and well written book of instructions for mounting, operating and repairing their motors, and even an inexperienced hand should find no difficulty in keeping his motor in the pink of condition.

All wearing parts are arranged to be easily accessible for adjustment and renewal. On the whole, the new motor seems to open a hopeful field for those who have no hope of electric power in the immediate future, and their name is legion, as the arc lighting companies know.

—— The Superior Electric Light Company, Superior, Mich., have been and are making some vast improvements at their plant near the foot of Winter street. Five incandescent dynamos and one arc dynamo are now being used, all being driven by two engines of 126 horse-power each. The company are now furnishing 1,630 lights.

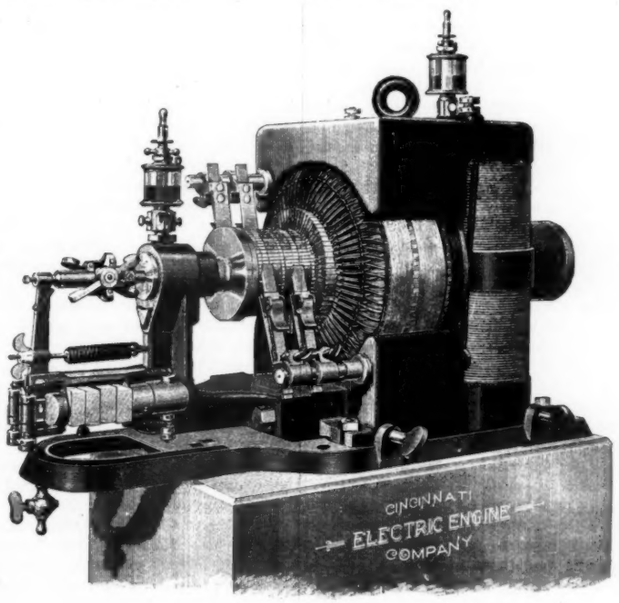
—— The Municipal Electric Light and Power Company's (St. Louis, Mo.) plant, when finished, will be the largest of its kind in the West. The company secured suitable ground on the south of the railroad, between Eighteenth and Nineteenth (Johnson) streets, and west of the last named, which is being tunneled under. The building will front on the railroad and also on Johnson street. The cost of the building alone is to be $185,000, and the fittings and fixtures are to cost $650,000, making a total, with extras, of nearly $900,000. The total frontage is 430 feet, of which, however, 50 feet has to be left open for Johnson street on its new grade. The power house is to be 270 feet long and 100 feet deep, and is to be occupied by 12 engines each of 500 horse-power. The engine beds are nearly complete and are marvels of solidity. The base of each rests on four feet six inches of solid concrete above the natural rock, and no less than 650,000 bricks have been used in building them. The walls of the structure are two feet six inches thick. The power house is to be four stories high, the first being 20 feet high. The second floor is to be given up to the pulleys, the third to dynamos, and the fourth to repair shops and storage rooms. The design is very handsome. The windows and doorways are all elegantly finished with arch tops, and the stonework at the base is well carved. The monotony of the front is to be relieved by seven pilasters. The boiler house is on the west side of Johnson street, and is being erected very rapidly. The dimensions are 110 by 60 feet. The smokestack foundation has been dug out 27 feet below the level of the railroad tracks, and seven feet of solid concrete put in. The stack will be 226 feet high and 32 feet in diameter at the base. Twenty-one vertical boilers will be used, each 11 feet in diameter and 22 feet high. A special design in this department is the laying of railroad tracks over every boiler, so that fuel can be unloaded rapidly just where needed.

—— The Palmer Electric Light Company, Boston, Mass., has elected the following officers: President, J. S. Holden; vice-president, C. L. Gardner; treasurer, C. B. Fiske; clerk, W. W. Leach; directors, J. S. Holden, C. B. Fiske, W. W. Leach, C. E. Fish and Thomas T. Robinson.

—— The Middlesex Electric Light Company, Lowell, Mass., has ordered an additional 1,000-light alternating dynamo, one 50 light arc machine and a 200 horse-power engine to supply the demand for electric lighting in the city and suburbs. The company has now 550 horse-power in two engines.

—— The contract for illuminating the city of Pittsburgh has been awarded to the Westinghouse Company, their bid being $141,158. The contract is for a plant containing 52 towers and 216 arc lights, 100 mast irons with one light each and 2,130 incandescent lights. Fifteen of the towers will be 125 feet high and 37 will be 150 feet high.

—— It is reported on reliable authority that the Thomson-Houston Electric Light Company has purchased the Sheldon property on Union street, East Bridgewater, Mass., with the privilege of the large water power at that point. The company will control the flowage back for several miles along the Matfield River, and will soon erect a large building at that point.



—— The Columbia Electric Light and Power Company, Columbia, Pa., were awarded the contract for lighting the borough for one year at $4,000 for 44 lamps.

—— The Missouri Electric Light Company, St. Louis, Mo., is just completing a splendid power house and electric distributing plant at Nineteenth street and Lucas place. It is now running four dynamos, each of 1,000 incandescent lamp capacity, and is putting in machinery for double that number of 16 candle-power lights. The Missouri's contract with the city is but a part, though a large part, of its business, as it has many other extensive customers in various parts of the city.

—— The Jeffersonville Electric Light Company, Louisville, Ky., with a capital stock of $25,000, filed articles of incorporation for a period of 50 years, with Recorder Peaceley recently. The directors are Henry Peter, Ed. J. Howard, John Adams, F. W. Poindexter and John C. Zulauf. The gas company's contract with the city for lighting the streets, expires February 1, 1890, and this company is incorporated to succeed the former, if possible. The Electric Lighting and Gas Heating Company, however, was granted a franchise by the city in 1882, and may have a preference over the newly incorporated company in the matter of illuminating the city.

—— The Albion Electric Light Company, of Albion, N. Y., is making arrangements to proceed with the erection of its building and the construction of the plant.

—— The Westinghouse Electric Company, Pittsburgh, Pa., have informed their workmen on Garrison alley that they will be expected to labor both day and night during the next few weeks. Dynamos for the large electric light plants in London call for extra work.

—— The wires for the electric lights to be put in at Fairhaven, Mass., have already arrived, and the cable to be run under the drawbridge has been ordered. Poles will probably be set up in Fairhaven next week. The stormy weather has greatly interfered with the work.

—— The Middleboro Electric Light and Power Company, Middleboro, Mass., are taking many new orders for incandescent interior lighting since their incandescent dynamo has been started up for the first time, and is giving the best of satisfaction in regard to quality of light.

—— Lancaster, N. H., people are soon to have an electric light plant in operation. The Thomson-Houston system will be used and some of the machinery is already on the road. A special dynamo is being built for this plant, and it is said to be the finest one east of Portsmouth.

—— The Jamestown Common Council has decided to make a contract with the Jamestown Electric Light and Power Company, Jamestown, Pa., for lighting the streets. Not less than 80 lamps will be furnished.

—— The Thomson-Houston Electric Company, of Boston, are to furnish for the Middlesex Electric Light Company an additional thousand light alternating incandescent dynamo, and also one 50-light arc dynamo. The increased demand for electric lights throughout the city makes these extra dynamos necessary. In addition to the two engines now in use of 300 and 250 horse-power respectively, J. H. Houghton, of Boston, is going to put in immediately a third engine of 200 horse-power.

—— The city council, of Griffin, Ga., has accepted a bid for electric lights from the Thomson-Houston Company. The contract stipulates 30 arc lights at a rental of $260 per month, for a period of five years from the turning on of the lights the first time. The time allowed for the completion of the work is 100 days, though it will hardly take that length of time, as this company set in a lot of poles in the spring and afterwards abandoned the work, owing to the city's failure to accept their offer of $240 rental per month, which they now do. The citizens are hopeful of securing better lights—a thing much needed.

ELECTRIC LIGHT NEWS

—— The Hollins syndicate is buying up electric lighting interests in the city of St. Louis.

—— An electric light company has been formed in Victoria, Texas, and that city will be lighted by electricity within the next two months.

—— The isolated department of the Thomson-Houston Electric Company at Lynn, Mass., will have an exhibit of its apparatus at the coming Maritime Exhibition in Boston.

—— The Nantucket Electric Light Company, Nantucket, Mass., is to put in another and larger dynamo. The company already has orders for lighting several dwellings, and for arc lights for the streets.

—— The New Bedford Gas Light Company, New Bedford, Mass., has just received a 50 lighter half-arc dynamo and ordered another calculated to run 1,500 incandescent lights.

—— The Thomson-Houston International Electric Company has declared its regular semi-annual dividend of 3½ per cent. on the preferred stock, payable October 10th to stock of October 1st.

—— The Salem Electric Lighting Company, of Salem, Mass., have commenced running separate wires from Salem to Peabody for the purpose of furnishing incandescent lights.

—— The Electric Light Company, of Quincy, Mass., has decided that on and after January 1, 1890, house owners who put in the lights will be required to pay for the labor and material used in wiring.

—— The Westboro, Mass., Electric Light and Power Company is to double the capacity of its plant at once. An incandescent dynamo with capacity for 750 lights, a 120 horse-power boiler and a 100 horse-power engine will be added.

—— The factory of the Metropolitan Rubber Company, Wallingford, Conn., is to have over 200 incandescent lights. The Thomson-Houston Electric Light Company, of Boston, furnishes the plant, and workmen from New York are now running the wires.

—— A two-story brick building is being erected at Rochester, N. Y., for the electric light company there, and will have facilities for introducing steam machinery of 2,000 horse-power. A new dynamo of 50-light power has been substituted for the 30-light dynamo.

—— Another new use for electricity has been discovered. It takes the place of the sand box on locomotives. The current from a small dynamo passes into the drive wheels of the locomotive and increases the friction at the point of contact with the rails. The Reading Railroad Company has made the experiment and pronounces it a success.

—— The Union Railway Company, Providence, R. I., are expecting two electric cars of the storage system pattern, which are to be used on their road solely for experimental purposes. The motive power for the cars is to be furnished by the Narragansett Electric Lighting Company, and as the stations of that company are more easily accessible from the Olneyville and Elmwood lines, the trial will probably be made on that circuit.

—— The new Pullman vestibule sleeping cars, now in service on the Pennsylvania Railroad's New York and Chicago limited, are illuminated not only by stationary controllers, but by movable electric bulbs. These are attached by insulated wire to the window posts, and can be placed in any desired position. One can sit or lie in one's berth and read with the same facility as in one's private sitting room. The lights are of wonderful convenience to travellers who would spend their evenings in reading.

Electric Lighting—Its Hazards and How to Guard Against Them.

BY C. C. HASKINS.

Read before the Twentieth Annual Meeting of the Fire Underwriters' Association of the Northwest, at Chicago, Sept. 18th, 1889.

There is something which pervades the entire universe, so far as we know—that is we believe it does—which is intangible, which possesses under certain circumstances a potency to move machinery, to perform chemical wonders, to give us light or heat or both, which is powerful to kill and to burn. We can produce it—develop it is perhaps the better term—by friction, by chemical action, by the action of magnetism moved in the vicinity of a wire, and yet alas! we have not been able up to the present time to state positively what it is. We ask those who have carefully investigated the matter and one (Prof. Cross of the Massachusetts Institute of Technology) answers: I think we may perhaps get the best idea of it which we can in a brief time, if we think of the three different kinds of things we have to deal with, which are first, ordinary matter; second, energy; third, electricity. Electricity is without inertia, the fundamental characteristic of matter. Neither is it a form of energy, yet it can be measured; and the telephone shows us that it may move in waves like water or sound.

Dolbear tells us that to matter, ether and motion we must attribute all electrical as well as other phenomena. He argues: "Energy is the embodiment of motion. All the so-called forms of energy are due to different characters of motion. Transformation of energy is only changing its motion from linear to vibratory or rotary motion. If motion is indispensable to electricity, it follows that the result is a form of motion, and not a third something that can be summoned like a ghost to frighten man or do him a service and then cease to be."

Mr. Warren S. Hill, of Boston, at a meeting of electricians in that city, asked this pertinent question: Did it ever occur to you that no mechanical work, no motive power can be obtained from any source except it comes by the use of a current, or flowing, of whatever the medium may be? You have the whole ocean of water, but not a wheel can turn with it until you get it into the form of a current. A current is caused by creating a difference of potential. Raise the water above its natural level, and as it falls back in obedience to the natural law, the current thus obtained may be used to turn the wheels and thus to do mechanical work. Magnetism is an element or condition in nature. Electricity is a current of magnetism. By creating a difference of potential we get a current of magnetism, and it is this that we call electricity. Prof. Silvanus P. Thompson tells us that while electricity resembles both matter and energy in the one respect that it can neither be created nor destroyed, yet it is neither matter nor energy.

Up to the present time it has been far easier to say what electricity is not than what it is.

We know it as we know heat and light and magnetism, by its effects, and we shall shortly see that we can convert it into either one of these three manifestations.

Electricity may be developed by several distinct methods. You have, probably, all noticed, at some time or other, the peculiar clinging of a child's hair to the comb when dressing. You have seen the sparks and heard them snap when smoothing a cat's back. You have probably seen that a sheet of paper on the desk or table will sometimes show a decided affinity for the table or the sheets beneath it after being rubbed with a rubber eraser, and have perhaps seen a spark generated by the friction of slippered feet on a thickly carpeted floor. These exhibitions, which are more certain in a clear, cold atmosphere, because of the dryness of that medium, are all manifestations of electrical energy. The spark developed by sliding across the parlor carpet is a very minute representation of a lightning discharge, and the diminutive snap which accompanies it is pigmy thunder.

Again, we can develop electricity by chemical action. Place a copper cent on your tongue and a bit of zinc or a silver coin beneath. There is no effect until the two metals are brought into contact at the tip of the tongue, when you will discover a metallic, brassy sort of taste, which is the taste indicative of the current. The copper being replaced by carbon, and the moisture of the tongue by a jar of weak acid, we get more current, and by combining several of these jars we get an increase of electrical pressure. Again, in generating sparks from a frictional machine, we who have a delicate sense of smell may be enabled to detect a peculiar odor which is the result of this development. The chemists call this ozone. It is one of the results of electricity developed as shown.

Another method of developing electricity is something more complicated, but still capable of demonstration. You are all aware of the fact that a steel needle or bar when suspended freely in a horizontal position, will come to rest in a generally north and south direction, because a force which we call magnetic attraction brings it to that position when left free to move horizontally. This force we call terrestrial magnetism, and to this directive power we owe to the mariner's compass, without which navigation would be far less certain than now. From this magnetic power we can develop electricity, as we shall see by and by.

We can then see, feel, and I have almost said taste and smell this curious manifestation, we can produce light, heat, magnetism, power with it, and yet we cannot show it to be a tangible body; it is not matter, and it is not energy. It is simply electricity.

It may have more or less quantity, and it may be of a higher or lower tension or pressure. Within certain limits these may be controlled, and proper combinations of the two attributes may be maintained for desired results.

Now there are in the electrical vocabulary terms which indicate these and other peculiarities of electricity. We say of electricity that it flows, and compare it to a stream or current of water. We say a current of electricity. If that current, as we assume it to be, has much force we say it is a current of high potential, and if it has but little pressure we say it is a low potential current, while if more current passes in a given time we say it is a current of greater quantity or intensity. And as to the capacity of any metal or other substance through which the current is to pass, we say that substance has greater or less conductivity, or inversely we say it has more or less resistance; resistance being the reverse of conductivity.

There are units of measure for each of these capacities. The amount, mass or quantity of current which a conductor is capable of carrying safely is measured by what we know as amperes. The pressure of a current flow is told in volts. The obstruction offered to the flow, the resistance, we measure by ohms.

So many amperes, so much current;
So many volts, so much pressure;
So many ohms, so much resistance.

These three technical terms are coming to be so much used just now, and are so thoroughly miscomprehended, that I have thought it well to emphasize the definition, to the end that they shall be better understood.

In the production of light from electricity experience long ago showed that the use of battery current, while perfectly feasible of accomplishment from the standpoint of possibility, is on a practical basis utterly barred out because of cost. We can produce current many times cheaper by the consumption of coal than by the consumption of zinc. Coal fuel is cheaper than metal fuel; and while to the uninitiated a scheme for producing light by means of primary batteries may possess a glittering fascination, and the plausible arguments and statements of the schemer seem to be based on solid ground, the fact still remains uncontroverted that a given amount of a given pressure and flow of electricity developed from the chemical burning of zinc or other metal is more expensive than a like result achieved by the combustion of coal. Coal is cheaper than zinc.

This being the fact, the battery electric light went no further than the laboratory, save in a single instance when Moses G. Farmer lighted his premises for a portion of one season as a practical experiment and an electrical novelty. It remained for some discoverer to give to the world a method of electrical development which had the element of greater economy to make it more practical.

The electrical generator we know as a dynamo accomplishes that end. By means of a rapidly revolving portion of the apparatus a current is generated, and sent to line through the lamps, giving heat and light in varying proportions according to the size and the number of turns of wire in the various parts of the generator.

These generators are known as high potential or arc light machines; low potential or direct incandescent machines, and alternate current induction machines.

The first, or high potential generator, is that which gives us the arc light such as is seen around the outside of the building, on the street, etc. It generates a current of constant quantity with a pressure of a given number of volts to each lamp in the circuit. These figures vary a little in the different systems, but from 45 to 50 volts per lamp is the usual pressure. You will see that the more lamps we place on such a circuit the heavier the pressure, and the greater the possibility of an escape of current.

The second form, the low potential, or low current generators, give us a current in which the pressure is uniform but the quantity is a variable element. The incandescent lamp is one in which the light is produced within an exhausted globe. In this system the quantity generated is proportioned to the number of lamps in the circuit, each added lamp demanding a certain amount of current, while not affecting the pressure.

The third form, the alternate current machine, is entirely different in most respects from either of the former mentioned generators.

I have told you that the movement of a magnet near a wire properly arranged will generate a current of electricity. If I move it in one direction I shall get an electrical impulse which is of one character, say positive, and as I draw it away, I shall get a reversed or negative impulse. This was the first step.

This same result, the approach to and receding from the coil was next accomplished by rotary instead of rectelinear motion.

The magnet was made stationary and the wire was moved across the face of the magnet, and finally a bundle of wires was made to revolve before the face of the magnet. As one of these wires in this bundle approached a magnet, an electrical impulse was generated in the wire, and as it receded from the magnet, a second electrical impulse was generated, but the two impulses were opposed in character—one was negative while the other was positive. The current flow was not a continuous one. In this form it is not available for ordinary lighting, but is readily conveyed upon wires of moderate size. This primary current is used to generate or induce a secondary current through the action which a current has upon a second wire, which is not in metallic connection with it. The secondary or induced current is used for incandescent lighting.

In order that the impulses of which I have spoken, may be continuous in direction, on the shaft of the bundle of wires, or armature, the ends of the wires forming the bundle are brought separately to segments of brass surrounding the shaft. These segments are separated electrically, by some substance which will not carry electricity readily. They are insulated from each other.

This combination of segments surrounding the shaft, and being part of it mechanically, though not electrically, is made up of many—sometimes as many as 64 segments. Resting on two opposite sides of this commutator, as we term it, are the brushes. These brushes are flat, pliable pieces of sheet copper, and form the connection between the commutator and the line. Now when the machine is set in motion, every negative impulse, being at one (say at the top) side of the commutator, is carried off by the top brush while the other or positive impulse is taken care of by the other or under brush. From the negative brush the wire leads to the first lamp on that side of the circuit or line, and from the positive to the first lamp on that side of the line, and so on throughout the circuit, which is metallic, or without ground connection.

This is the constant current or high potential—high pressure—system, in which the volts increase with increasing numbers of lamps—but in which the quantity or mass of current is constant.

The direct incandescent system dynamo generates its current in the same manner as the last, but the circuits, the wires, are very differently arranged.

The two wires leading from the commutator brushes, unlike the last, do not come together, forming a metallic circuit. Each is carried as far as required, and is there left open. Other wires are carried from these in various parallel directions, and again, and again, until the premises are sufficiently wired for the purpose required. Each time an additional branch is taken from the positive side, a similar wire is carried from the negative side, and at each such branching a safety device is placed to guard against fire. Each subsequent branch too is usually of smaller wire than that from which it leads, for as the line extends the less number of lights beyond it requires a less amount of current to feed them, and a smaller wire will carry this current.

These safety devices are formed of a metal which has a less carrying capacity than the wire in that branch. So if an increase of current accidentally happens the soft metal will melt, and break or open the line and stop the flow in that branch entirely.

With a given kind of metal or alloy the amount of current, the quantity, irrespective of the pressure, is determined by its size, and the more lamps we have to supply current for, the larger must be the wire at the generator, and the smaller in proportion will be the wire at the farther ends of the circuit.

Now, having the wires placed, the lamps are put in, connected across between the wires, like bridges. As, according to what I just told you, the greater the carrying capacity the greater the current flow may be. You may see how an increase of carrying capacity is accomplished by putting in lamps. With no lamp in there would be no flow. With one there would be about half an ampere for an ordinary lamp, and each lamp would afford a passage-way for half an ampere. It is just like drilling holes in a water pipe; each hole would leak its own quantity, proportioned to the size. The water would flow back to its level—and so does the electrical current—it simply runs down hill.

In all these cases a current of electricity is assumed to follow the metallic path which we call a circuit. It is not intended that any portion of the current should find its way to earth, to the ground, under any circumstances. The reason for this is that in electric lighting the currents are too powerful to be thus trusted. There is no difficulty in using the earth as a return wire, or part of the circuit, and it would seem at the outset an economical method. It is done in telegraphic and telephonic circuits.

We cannot permit this in electric light work, for in one form the quantity of current would threaten us with conflagrations, while in the other form danger to life would constantly stare us in the face.

The telephone system uses an electrical current, which compared to that of the electric light, is almost as one grain of sand to an acre of seashore, and the telegraph people use a pressure not potent for mischief and a quantity which is a minimum. The pressure of one electric light current may be as high as 2,500 volts or more, having eight or ten amperes flow, or another may have several thousand amperes with a pressure of 110 or 220 volts. The horse power of a current is determined by multiplying the amperes and volts together, the result being counted in Watts.

To render a line using a current of con-

stant pressure safe we must needs look in two directions. First that the insulation is proper, and second that the carrying capacity of the wires bear a proper proportion to the maximum flow of current. A wire which would only carry a sufficient current for 10 lamps, for instance, should not be made to carry current for 20 lamps. A hose calculated for a maximum water pressure of 60 pounds would not be expected to carry 120 pounds uncomplainingly. Something would give way in both instances. In the case of the hose there would be a rupture. In the wire heat would result. An obstruction to the passage of a current always results in heat, and this heat is what the electrician avails himself of to melt out the safety strip, and shut off the current flow. With a properly installed and constructed system of incandescent lighting the dangers of fire are reduced to a very low minimum indeed.

While the safety device is the principal reliance in constant potential systems, the general insulation of the plant is also to be considered and must not be slighted.

With the constant current systems the case is different. We have really no means of protection here, save in the insulation. A thousand and one enemies of this important factor of safety are constantly on the alert to overthrow our best endeavors. The electrician is compelled to anticipate, to guess ahead, to peer into the future, for probabilities. He is forced to ask the question: "If I put this wire here, will a leak occur from that pipe? or will the steam from this pipe thaw out and ruin any insulation?" If he goes through a partition, he makes a shrewd guess as to whether the rats may not take advantage of the beginning he has made to open a lunch route through the partition, and gnaw into his wire or cable because it is in the way of their enterprise. He goes through a damp cellar, and takes particular pains to eschew places where storage of boxes, barrels, refuse of all kinds may be accumulated by-and-by, for fear of injuries to his line and consequent mischief. There should be no more danger from electric light wires than from any other known force or energy. There is nothing in the form of power which is not dangerous if uncontrolled. Nothing which is of benefit to mankind that has no danger in it, and the more beneficial to humanity the more circumspectly must it be handled—the more formidable must be the safeguards which surround it. The very heat of the sun is capable, under favorable circumstances, of costing an insurance company, or of producing fatal results to an insurance agent. Fire is one of the most valuable and grandest gifts of the Creator, but we have to constantly watch and fight to keep it under proper control.

Steam, water, gas—yes, even gas—has been known to sadly disfigure the cash account of many an insurance company. Yet gas is more than a luxury to mankind.

Electricity has come to stay, has shown itself an excellent servant. What is necessary to do is to prevent it from assuming the role of master. As a strong temperance man once said to me, "What is wanted is not prohibition in the electric light business, but proper regulation—high license, perhaps."

Each locality has its own best methods of accomplishing this regulation for itself.

Insurance men in New England, for instance, are gathered together in a body known as the New England Insurance Exchange, and that body controls a goodly share of the insurance of the territory of the Eastern States, outside of Boston and New Hampshire. There are somewhere near a 150 of them, with headquarters in Boston, where they flock in every Saturday and have a meeting. In the district named this body dictates rules, and the inspector examines to see that the installations are in accordance with the rules of the Exchange. The city of Boston has a separate Exchange or Union, which has its own inspector and its rules. New Hampshire has its own methods and its rules, and in nearly all large cities the underwriters exercise the prerogative of electric inspection.

Chicago early took a stand at variance with other places. The underwriters here put the matter one side, and said to the city authorities, "Make you own restrictions and furnish your own inspector." The compliment to the heads of the fire and electrical departments of the city was by no means an empty one. So thoroughly was it meant, that to-day not one out of a dozen of the Chicago Board of Underwriters has ever spoken with, I had almost said spoken of, the inspector with whom they are trusting their property and their risks.

But there are representatives here to-day who are perhaps mentally asking how shall we who are doing business where there is no inspector, either belonging to the underwriters or the municipality, accomplish the safety which arises from inspection of electric plants.

As an insurance man, I should certainly require an inspection of every plant in my jurisdiction, if it were possible of accomplishment. If I could not reach an expert within my own territory, I would borrow one from my nearest neighbor. I would log-roll with the council, or the board of control, or whatever the name of the governing body of the town was, and get some sort of arrangement made, some kind of ordinance passed, and insist on the enforcing of it, by which immunity from danger could be secured to persons and property.

Once such a move is inaugurated in a city, it goes of itself. The electric light people never object to inspection. There was a day when they felt differently on the subject, but they have learned and acknowledge that proper supervision of their work, like that of architects, and boiler makers, and vessel constructors, is a help instead of a detriment.

The causes of danger in an electric light plant are almost all of them directly traceable to faulty insulation—to a leak to ground in some portion of the circuit.

In towns of less inhabitants or area, where an inspector could not be made available, a fairly good substitute might be made, which would be productive of good results, by requiring the company itself, having a considerable plant, to furnish the proper authority with an occasional report of insulation resistance. These measurements made periodically, and filed with the insurance people, would wield a strong influence for safety. A travelling inspector might soon learn to verify these tests, if from any cause they were unsatisfactory, and the joint employment of such an expert would accomplish just what the New England Exchange did when it took up the matter; and certainly if a couple of inspectors can cover nearly all of five States, satisfactorily, the smaller towns of a State might be well cared for by a joint district or State inspector, whose occasional visits would verify the reports received of central plant inspections.

A plant properly installed, constructed with proper material, will, if unaltered, last for a long series of years without sensible depreciation in its safety qualifications. No alterations should be permitted in a plant without notification, under penalty of forfeiting the insurance. There is no hardship in this—it inures to the benefit of the insured, as well as the underwriter.

There is one point of vital importance to the underwriter which is too apt to be overlooked in its danger aspect, and that is the practice of procuring power, in the smaller towns especially, in the most ill-conditional localities for such purposes. We too often find the headquarters of an electric light plant in a wet basement, where the darkness in daylight is almost Egyptian. There is water everywhere—on the walls, ceiling and floor. Such a thing as proper insulation is almost an utter impossibility with such surroundings, even with the best of material. The danger to life as well as property which surrounds such plants makes us wonder at the low rate of losses occurring from electrical illumination and power.

There is an argument which will have weight, and which the underwriter can with justice use with the electric light man. The underwriter should say to him, we are anxious to insure your property and that of your patrons. You and we are working together, we are friends. Now, show us by results the freedom from danger of your methods, and we will help you by reducing the rates on the property, proportioned to the lessened danger. If you will show by statistics that the premium should be less by reason of greater safety with electricity than with gas, we will meet you half way. But go on stringing your wires under and over and through our patron's property regardless of electrical laws and common prudence, so as to do a cheap job and get away with the proceeds before an accident occurs, and you cannot expect, nay, you will not receive any consideration from the insurance people. "The pocket is the tenderest part of the human organism," it has been said, and appeals to the purse are seldom unheeded.

The insurance man, while a benefit to mankind is dependent upon the misfortune of others for his livlihood, and, at the same time, the larger the aggregate of these misfortunes the greater the need of the underwriter. A sort of philanthropist, and he should extend the right hand of fellowship to that other philanthropist, who is certainly a public benefactor, who gives us a light free from those deleterious sanitary effects consequent upon the combustion of the air we breathe, and the filling of our lungs with lampblack.

The underwriter may help materially by refusing to write up a risk without some surety that the wires are in proper condition—by notifying the inspector when alterations are made in buildings, whether these are done by carpenters, plumbers or other mechanics. The most perfect electrical plant in existence may be completely ruined by a common helper, without half trying, or even knowing what he has done, and endanger an entire structure or the life of some individual.

These innocents have their place in the economy of the world, but as a rule they make very inferior electricians.

Annual Report of the United States Commissioner.

C. E. Mitchell, the Commissioner of Patents, has filed with the Secretary of the Interior the preliminary report of the operations of his bureau for the year ended June 30, 1889. There were received during the year, 36,740 applications for patents; 808 applications for design patents; 101 applications for re-issue patents; 1,281 applications for registration of trade marks; 772 applications for registration of labels, and 2,345 caveats, making a total of 42,047. The number of patents granted during the year, including re-issues and designs, were 21,518. Number of trade-marks registered, 1,111. Number of labels registered, 312; making a total of 22,941.

The number of patents withheld for non-payment of final fees was 2,858; number of patents expired, 11,820. The receipts from all sources during the year aggregated $1,186,557; the expenditures including printing and binding, stationery and contingent expenses $999,697; leaving a surplus for the year of $186,860, which makes the total amount in the United States Treasury to the credit of patent fund, $3,524,526.

A comparative statement shows that the receipts of the office were $62,563 in excess of those of last year, while the expenditures were $45,967 in excess of those of 1888. At the close of the fiscal year 1888-1889 the business of the patent office, says the report, was in a satisfactory condition as compared with former years.

The Monthly Stock Bulletin of the Westinghouse Machine Company, issued August 1st, shows 232 completed engines in their warehouse, and 218 engines in progress through the shops. This makes a total of 450 engines, aggregating 22,500 horse-power. Orders for the past six months have averaged nearly 1,000 horse-power per month more than the out-put; hence, the present stock of engines, large as it is, is much below the normal. The shops are now running on double turn, and adding a line of heavy tools, and it is expected that their present capacity is fully 5,000 horse-power per month. It is the practice of the company to keep in stock for immediate delivery a full line of engines of every style manufactured by them, from a five horse-power Junior engine to a 300 horse-power compound engine. At present they are oversold in some sizes, particularly in the compound engines, for which there is an extraordinary demand.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING SEPT. 24, 1889.

411,414 Electro-magnetic separator; William A. Anthony, Manchester, Conn., assignor to Mather Electric Company.

411,423 Safety switch for incandescent lamps and other electrically controlled devices; Oscar S. Bussman, assignor to Bernstein Electric Light Manufacturing Company, Portland, Me.

411,426 Process of generating electricity by gas batteries; Olof Dahl, Brooklyn, N. Y.

411,427 Conduit for electrical wires; Chas. C. Dashiell, Washington, D. C.

411,448 Globe frame for electric arc lights; Joshua W. Jones, Harrisburg, Pa., assignor of one-half to David, same place.

411,452 Incandescent electric light fixture; Philip H. Klein, Jr., New York, N. Y., assignor to Bergmann & Company, same place.

411,474 Manufacture of carbons for incandescent lamps: John S. Sellon, Hatton Gardens, County of Middlesex, Eng.

411,496 Electric railway; Geo. B. Fraley, San Francisco, Cal.

411,551 Regulator for shunt wound dynamos or other electrical apparatus; L. S. Harris, Detroit, Mich.

411,588 Telephone holder; Chas. T. Dickson, Cincinnati, Ohio.

411,595 Underground conduit; David M. Hyland, Chicago, Ill., assignor of one-half to Jno. P. Barrett, same place.

411,611 411,612 System of synchronizing electric motors; Robt. H. Read, Washington, D. C.

411,613 Trolley for electric railway systems; Andrew L. Riker, New York, N. Y.

411,629 Armature; Chas. F. Winkler, Hoosick Falls, N. Y.

411,713 Arc lamp; Frank P. Cox, Terre Haute, Ind.

411,737 Electric water heater; Daniel W. Smith, St. Louis, Mo., assignor of one-half to J. C. Addington, same place.

411,749 Electric insulator; Louis McCarthy, Boston, Mass., assignor to Gould & Watson Company, of Massachusetts, and Chas. Tennant Lee, Boston, Mass

411,770 Telegraph key; Henry S. Tebbs, Nathan C. Lane and Vinton Coombs, Washington, D. C.

The Pond Engineering Company, St. Louis, Mo., has secured the contract for the pumping engines, boilers, etc., for the Belleville (Kan.) Water Works. They will also furnish the Hutchinson (Kan.) Water, Light and Telephone Company with a 100 horse-power Armington & Sims engine, with a friction clutch to the driving wheel.

The Billings & Spencer Company, at Hartford, have shipped from their factory over 36,000 of their drop-forged commutator bars to the Thomson-Houston, Edison, Westinghouse, Schuyler, Mather, Fort Wayne, Jenney and Daft Electric Companies, in different sizes, from two ounces to four pounds, while at the present time they are preparing another consignment for the Thomson-Houston Company. These commutators have been received with great favor by manufacturers of dynamos and electric motors generally.

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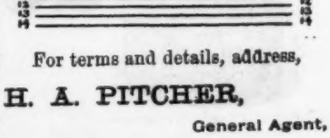

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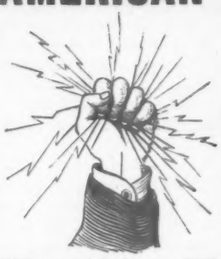

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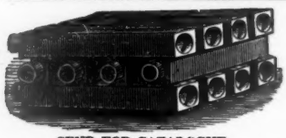

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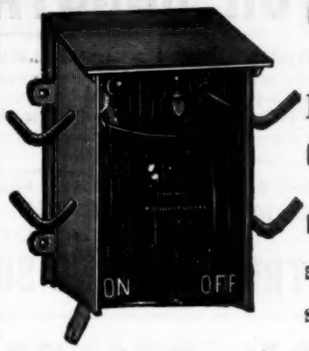

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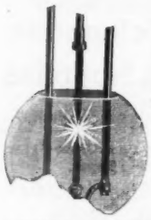

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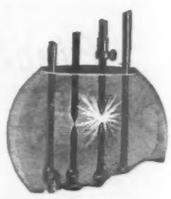

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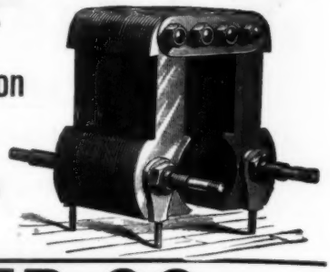

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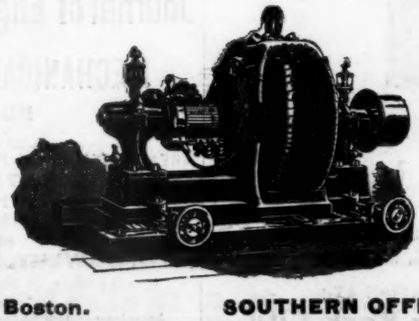

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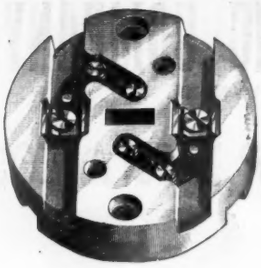

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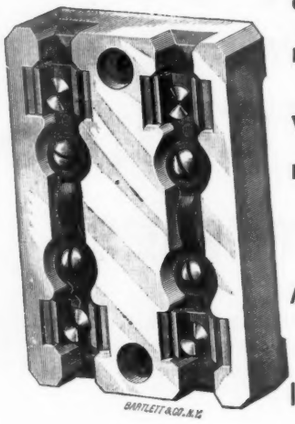

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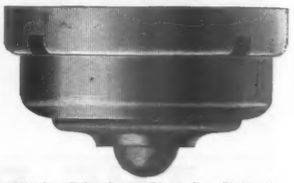

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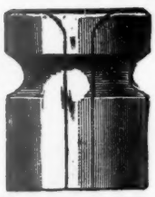

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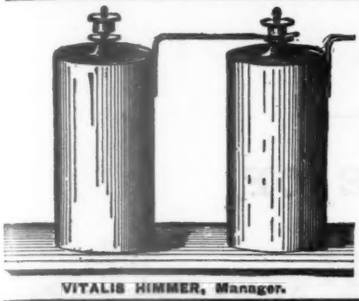

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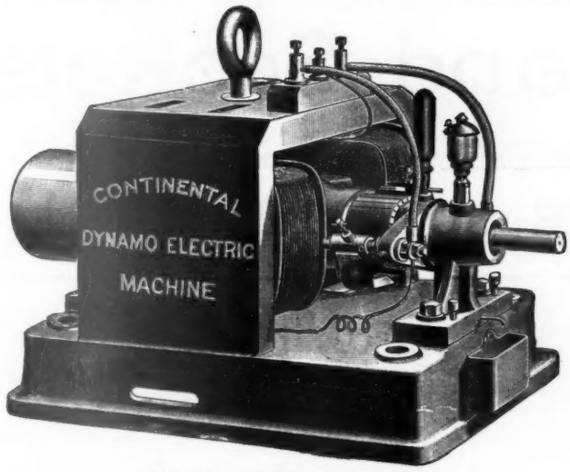

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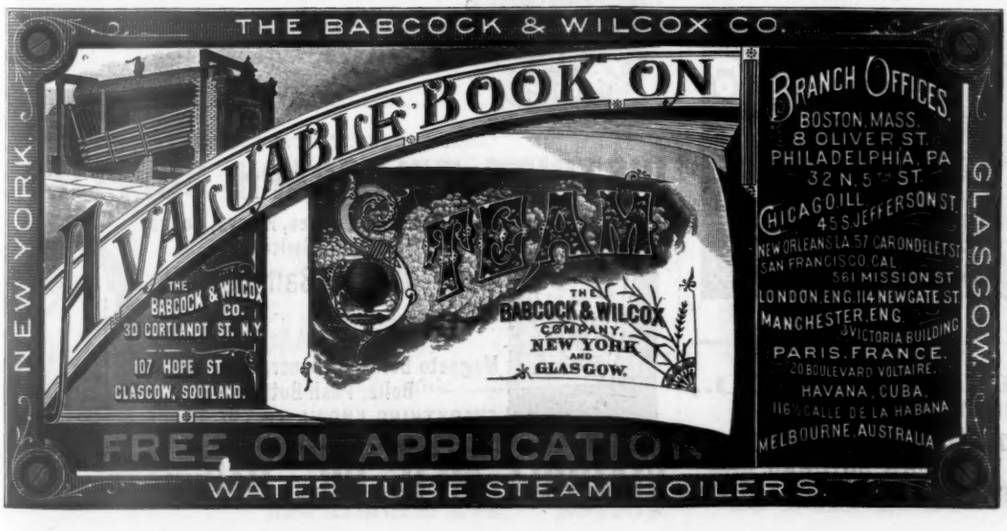
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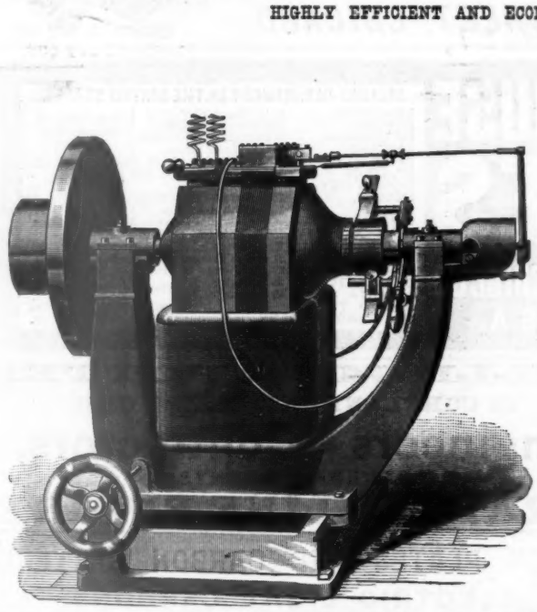

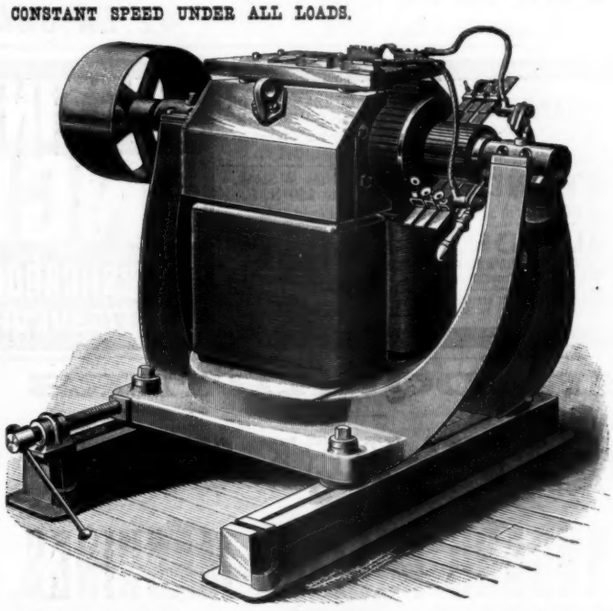

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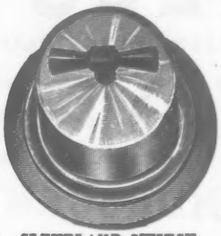
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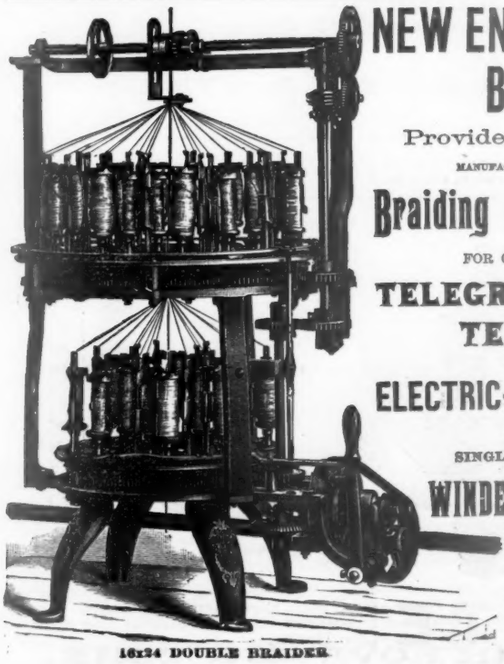
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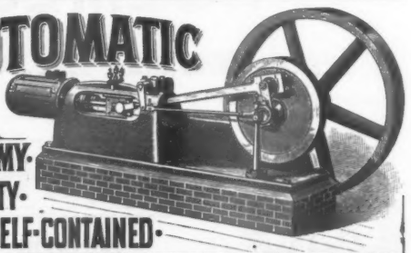
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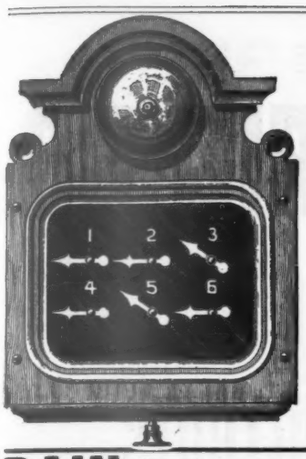

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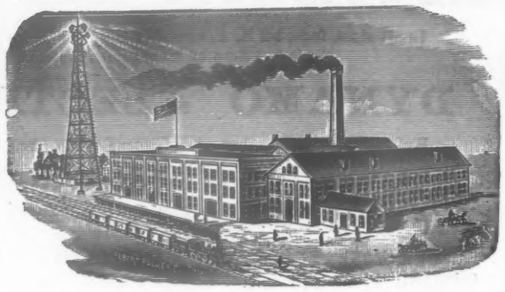

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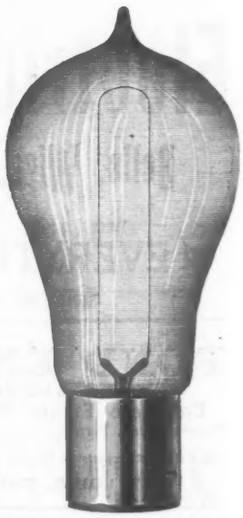

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